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ORIGINAL MEMOIRS.

THE DIRECTION OF THE JEJUNUM IN THE OPERATION OF GASTRO-ENTEROSTOMY.

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THE operation of gastro-enterostomy has undergone a considerable number of alterations since the day on which Nicoladoni first suggested its performance to von Wölfler. There is a general agreement, it would now appear, among all surgeons that the posterior operation is preferable to the anterior, chiefly because it allows of the opening being made into the jejunum close to the duodeno-jejunal flexure, so that the "loop" the cause of such various complications may be avoided. But it is not yet decided as to whether it is better to attach the jejunum to the stomach in such manner that the opening shall be with its long axis vertical, or inclined from above downwards to one side or the other. In the early descriptions I gave of the technique of this operation I suggested that the jejunum should be attached to the stomach along a line obliquely downwards and to the right. By degrees I came to make the opening more and more vertical until now it is usually as nearly vertical as I am able to make it; with an inclination, when there is one, slightly downwards and to the right. In my own hands this operation has given most excellent results. Vomiting, either immediately after, or at some long time after the operation, has been conspicuously

absent. The regurgitation of bile has not been encountered in at least 200 cases dealt with by this method. So much has it been lost sight of that those who have followed my work in recent times have had no experience of it. But this has not been repeated in the practice of others who have carried out what was intended to be an exactly similar procedure. Dr. W. J. Mayo and Dr. Munro of Boston, to name two of the most expert surgeons in gastric diseases, both met with occasional instances of bilious vomiting. To endeavor to find a better method, one in which this tendency to the regurgitation of bile should be eliminated Dr. W. J. Mayo (*ANNALS OF SURGERY*, 1906, i., 537) suggested that the jejunum should be applied with its long axis lying from above downwards and to the left. He pointed out that the jejunum on leaving the flexure passed to the left and backwards to the kidney pouch; when, therefore, the attachment of the bowel to the stomach was made along the line I had indicated a displacement occurred, which might result in a kink of the gut either at the flexure, or at the upper part of the union with the stomach. Though I did not, for reasons which I will presently set forth, agree with the opinion of Dr. Mayo, I felt disposed to perform some operations by the method he described. The results were not by any means so satisfactory as those to which I had happily become accustomed. In three cases in all I found that bilious vomiting occurred; in two of them it was slight; in the third it was considerable, bile was vomited in large quantities frequently. This was indeed the worst case of regurgitation I had seen since the days of my very early experience. The anastomosis was made in this instance as close to the flexure as possible, and it lay exactly along the line depicted by Dr. Mayo. My experience of this untoward complication was not singular. Mr. Rutherford Morison had the like ill-fortune, and I have heard of others. Clearly therefore there was some other factor than the mere direction of the jejunal attachment which must be held responsible. And I was much puzzled to discover what it was. Recently I had the opportunity of seeing the post-mortem

examination of the case in which regurgitant vomiting had occurred and it revealed the cause of the trouble. Death occurred with jaundice, ascites and emaciation, the cancer of the pylorus, for which the original operation was performed, having spread to the liver. When the parts were examined the jejunum was seen to be attached very close to the flexure along Mayo's line, and from the anastomosis the gut passed downwards and to the left into the kidney pouch; it was free from adhesions throughout. But between the flexure and the anastomosis a distinct twist was seen in the jejunum. It was as though the bowel before being applied to the stomach had been rotated around its longitudinal axis. The amount of the twist was small, but quite perceptible; and it was of course more appreciable since it was confined to that portion of the gut, just about one inch in length, which lay between the flexure and the uppermost point of the sutured line. When the anastomosis was separated, the opening in the jejunum was seen to be not exactly opposite the line of attachment of the mesentery. The rotation of the jejunum around its longitudinal axis, the flexure of course being fixed, had, I make no doubt, been ample to cause that partial obstruction of the gut that was responsible for the vomiting of bile. I think it more than probable that the same condition must have existed in those cases, related by Dr. Mayo and Dr. Munro, in which vomiting followed the application of the jejunum to the stomach along the line from above downwards and to the right.

In his paper Dr. Mayo considers that the normal direction of the jejunum as it leaves the flexure is downwards and to the left, to the kidney pouch. That the bowel lies often in this position when the parts are examined post-mortem, or when the abdomen is opened with the patient in the customary position during life, is true. But seeing that the flexure lies to the left of the vertebral body it is into this position that the bowel would naturally fall. If, however, the patient's position be altered by turning him to one side or the other and the abdomen be then opened the jejunal direction will be found

to vary accordingly. The attachment of the jejunum at the flexure is of such a nature as to allow it to go to left or right with equal ease, and with equal freedom from kinking at the meeting of the fixed end and the mobile parts. The value of the little suspensory ligament or meso-colic band in preventing any kink is perhaps not inconsiderable. That is, not improbably, its sole purpose. To say that the jejunum takes a certain line "normally" from the flexure is therefore probably neither accurate, nor reasonable. Its direction varies in accordance with the position of the individual, and in each position there is an easy transmission of fluid along its lumen. Were it not so we might suffer high intestinal obstruction as a result of sleeping on the right side at night. It is, of course, not very infrequent to find the jejunum pulled over to the right either by a long meso-colic band, or by adhesions between the jejunum and the transverse meso-colon. So far as my own experience goes, when the jejunum is adherent to the meso-colon it is always fixed on the right of the flexure and never on the left. If then any position may be assumed by the first few inches of the jejunum the mere direction of the line of attachment of the jejunum to the stomach is probably not the point of chiefest consequence in gastro-enterostomy. And I have no doubt that every surgeon has at times made an anastomosis with whose appearance he has been considerably displeased, and he has feared that troubles would ensue. This has, not once only, been my experience after the operation of partial gastrectomy. That the line of union which points from above downwards and to the right may be followed, in a long series of cases in succession without the slightest mishap my own cases show. That the line almost at right angles to this may be equally successful Dr. Mayo has proved. I suggest therefore that, as one might naturally suppose, one line is probably as good as another or any line between them as good as either, provided always that no twist be given to the gut at the time the anastomosis is made. Just as there is no "natural direction" of the jejunum, so there is no "best line" for the anastomosis; so far at least as the

mechanics of the operation are concerned. But my own choice for some time past now has been in favor of the vertical line; and since many of us spend most of our time in positions other than the recumbent one, this is probably the most frequent direction taken by the jejunum as it passes from its point of origin. The essential point, it seems to me, then, is to choose not so much a special line upon the stomach, along which the jejunum should be applied, but to chose on the jejunum as close to the flexure as possible, a line which can be directly approximated to the stomach without the gut being revolved around its longitudinal axis.

TRANSFUSION AND ARTERIAL ANASTOMOSIS.*

SOME EXPERIMENTS IN ARTERIAL ANASTOMOSIS AND A STUDY OF TRANSFUSION
WITH PRESENTATION OF TWO CLINICAL CASES.

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THE brilliant experimental results of the past few years, in the anastomosis of blood vessels, are rapidly bringing this operation into the domain of practical surgery.

In September, 1906, it occurred to the author that it ought to be possible to unite blood vessels by means of a rigid ring, in such a way as to bring intima into direct contact with intima, and leave no foreign body in the lumen. With this idea in view, in the course of five trials on the cadaver and eight animal experiments, he developed a satisfactory technique.

Up to this time, he had been acquainted only with Carrel's articles on blood vessel suture. Now, a review of some experiments by Jaboulay,¹ led him to other references; and following up the literature of the subject, he found that the idea was not at all new, but had already been put in practice by a number of other experimenters.

Nevertheless, the author desires to present these experiments, not because they represent any new achievement, but because the lessons he learned might be of value to others who desire to enter this new field of surgery.

It was the experience thus gained, and an acquaintance with Crile's work on transfusion, that prompted the writer to perform direct transfusion when two desperate cases of anaemia presented themselves.

Of the author's eight animal experiments, the first four are disregarded, as the method was still in a developmental stage. Although of the last four experiments, only one was

* Jaeger prize essay for 1907, at the German Hospital, New York.

¹ New York Medical Journal, Dec. 22, 1906.

PLATE I.

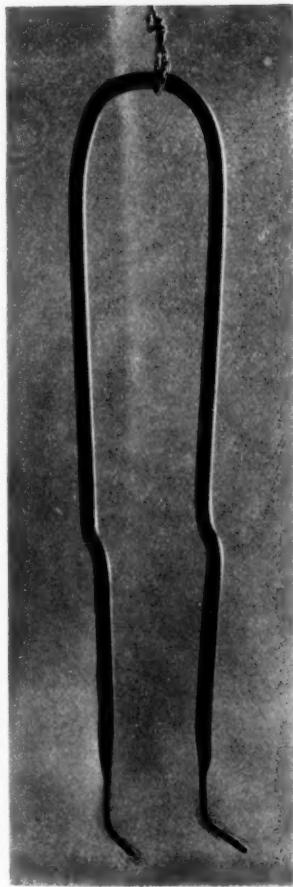
a



c



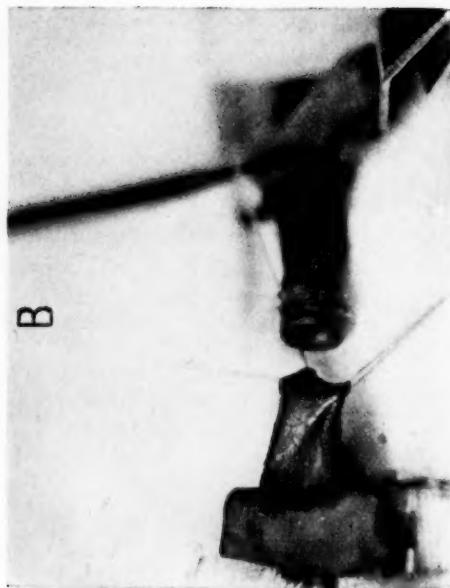
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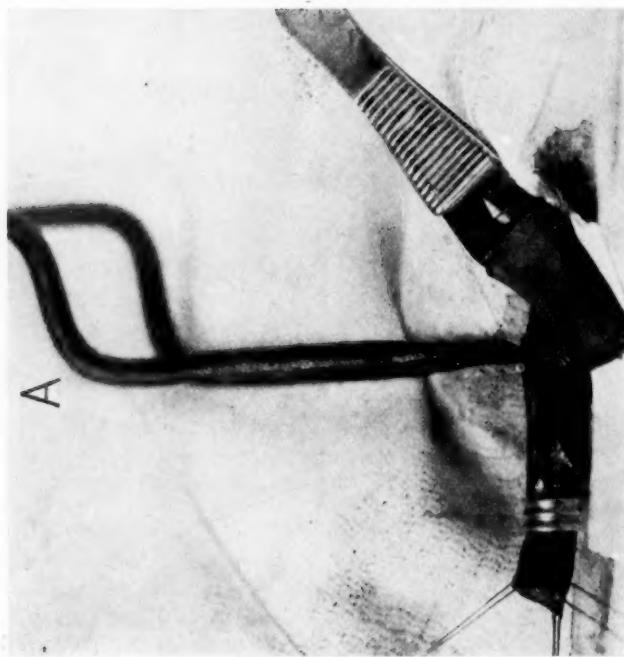
Instruments required for direct transfusion; *a*, the connecting ring; *b*, the tongs for manipulating the ring; *c*, the ring held by the tongs ready for insertion; *d*, fine forceps for use on the vessels.



B



C



A

PLATE II.—Technique of direct transfusions. (A) Vessel isolated and threaded through ring, ready to make cuff. (B) Cuff made, second vessel ready to be pulled over. (C) Anastomosis completed, clamps not yet removed,

successful, the three failures could be traced to very definite causes; and the results should, therefore, be of value.

The method (Plates I and II) is extremely simple. It consists in the use of a small silver ring whose surface has two grooves.² The ring is held by a self-retaining spring forceps, which greatly facilitates the procedure.³ The cut end of one of the divided vessels to be anastomosed is pushed through the ring and turned back over it like a cuff (see Plate II). This cuffing is very easily done if the open lip of the vessel is caught at three points in its periphery by three tension sutures of fine silk.

This cuff is then tied in place by a piece of fine silk in the posterior groove, and the other vessel is pulled over it. Then at once the two vessels are fastened together, intima to intima, by two fine pieces of silver wire, which fit into the two grooves. Silver wire is easy to put in place, and is absolutely certain not to slip, whereas silk, which was tried in the preliminary experiments, and which is recommended by previous writers, slipped in two of those experiments.

There are several points in technique, which, though small, are essential.

1. The vessels must be handled with the greatest possible gentleness, and must never be grasped with toothed forceps. Violation of this rule was the cause of failure in experiment No. 1 (*vide infra*). The best instrument for handling vessels is a fine bent forceps, known to eye surgeons as "curved foreign body-forceps," or "blood clot forceps" (see Plate I, d).

2. The part to be cuffed back has to be prepared by carefully cleaning off adherent connective tissue. This is best done by pulling the connective tissue sheath over the cut end and snipping it off with scissors. On the end which is to surround the cuff, it is best to leave considerable connective tissue.

² These rings were made for me by John Frick, No. 8 Liberty Place, New York.

³ This clasp was made, after the author's design, out of one piece of one-eighth inch steel wire, by Mr. E. Foy, former assistant engineer of the German Hospital.

3. Throughout the procedure, the vessels must be kept moist with normal saline solution.

4. About one inch of the vessel to be cuffed, and about one-half inch of the vessel to be pulled over the cuff, is all that one need expose. The part to be cuffed back is easier to manipulate if free from branches. If branches cannot be avoided, they must be tied close to the vessel, with fine silk.

5. The ring must be of exactly the right size; that is, its lumen must be just as large as the outer diameter of the vessel to be cuffed back, when full of blood. If one vessel is larger than the other, the ring should be put on the smaller of the two.

6. As in all plastic operations, there must be no tension. (Tension was the cause of failure in one of the preliminary experiments.)

7. The part to be operated on, must, so far as possible be immobilized after operation. For this reason all experimenters on dogs report a far larger proportion of successes with the vessels of the neck and interior of the body, than with those of the extremities. (See experiment No. 4 below.)

8. The best means of temporary blood stasis is the use of Billroth's hare-lip clamps, well protected with soft rubber tubing (see figures).

9. Sometimes the muscular sheath of the vessel contracts so as to render the procedure difficult. When this occurs, the muscle may be made to relax by application of hot saline solution, or the lumen may be gently dilated with a small hemostatic forceps.

10. Absolute asepsis is essential.

The first experiment.—Under ether, the right common carotid artery of a medium sized black dog was cut through and reunited. Only one silver wire ligature was placed around the ring.

Five and a half days later, a small hemorrhage was seen from the wound, (which had united by primary intention). After about eight hours the dog was narcotized, the anastomosis was exposed and removed. The point of anastomosis, itself, seemed in good condition; the ring was in place, and the wire had not cut through. About one-quarter inch to the cardiac side of the ring was a small rounded swelling, which



FIG. 1.



Ring anastomosis of carotid artery; traumatic aneurism in cardiac side of ring.

FIG. 2.



Longitudinal section showing result obtained by ring anastomosis of carotid artery.

FIG. 3.

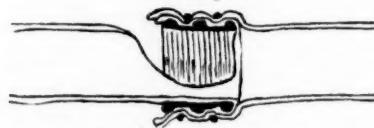


Diagram showing tear in wall of vessel from pressure of ring used in anastomosis of femoral artery.

e



had ruptured at its apex, (see diagram), and was filled with fresh clotted blood (Fig. 1). This was evidently the source of the hemorrhage, as no other source could be found. This traumatic aneurism was undoubtedly caused by the mouse-tooth forceps, which were used in this experiment, (but not in the later ones).

The second experiment.—The right common carotid of a fair sized hound was cut through and re-united; a silver wire was placed over each of the two grooves.

The wound healed and the dog remained in good condition. Three weeks later the dog was etherized and the anastomosis exposed. It was in perfect working order; the pulse in the vessel was almost, but not quite, as strong above the ring as below. The entire vessel was surrounded by a dense mesh of connective tissue which buried it securely. The segment of vessel was then removed, and experiment No. 3 was at once done on the same dog.

The segment removed, easily allowed water to be squirted through it; but, a day later, as the result of hardening in formalin, its lumen had so narrowed that a probe could not be passed through.

On closer inspection, after the specimen had been split longitudinally, (see Fig. 2), the lumen was seen to be clear but slightly contracted. There was an exceedingly fine line of organized blood clot between the two intimas, in the receding angle where they met. The wires had shown no tendency to cut through. The cuff and its envelope were losing their identity and becoming transformed into connective tissue.

The third experiment illustrates the result of even slight infection:—After the preceding specimen was taken out, the right internal jugular vein was exposed through the same wound, cut through, and quickly anastomosed. The largest ring at hand was about one-eighth inch too small for the vein, but was used. Toward the end of the operation several errors in asepsis were noted. One week later, the wound, which had united, was opened. The vessel was found, surrounded by a large pocket of serous exudate. The lumen of the vein at the point of anastomosis was closed by a ragged thrombus.

The fourth experiment.—The right superficial femoral artery of a fair sized dog was cut through and re-united. The entire operation, from the first incision to the last suture, took forty-five minutes.

Five days later, the dog was in good condition. The pulse in the right dorsalis pedis was exactly as strong as in the left. The dog was then allowed to run in the yard with the other dogs. The next day there was a hemorrhage from the wound. The dog had been very lively, and had attempted to jump over the fence at some rabbits in the next enclosure. On examination of the anastomosis, two thirds of the circumference of the vessel appeared to have torn on the edge of the ring, at the place where the cuff turned back (See diagram Fig. 3).

The chief dangers to be feared, then, are hemorrhage, thrombosis, and narrowing.

Hemorrhage ought never occur, provided that trauma to the vessel is avoided, and the part operated on is immobilized.

The prime causes of thrombosis are injury of the intima and infection; and elimination of these causes is merely a matter of technique. Narrowing of the lumen (which occurred in experiment No. 2, and in Jensen's experiments), can be avoided by the use of the proper sized ring. For this purpose, it is advisable to have a series of rings, in diameter from two millimeters up, and differing by about a half millimeter.

One other danger might be thought of—the occurrence of pathological changes after a considerable time, as the result of the presence of a rigid foreign body, or as the result of the abnormal anatomical relationships of the structures of the vessel wall, at the site of anastomosis. Whether such changes would occur can, of course, only be definitely settled by prolonged observations. But there seems no reason to believe that such a foreign body, imbedded in the scar tissues around the healed vessel, would do any harm. In those of Höpfner's experiments, in which the magnesium rings were not found absorbed, they had done no injury at the end of eight weeks. Silver wire sutures have, of course, been known to stay in the body for years. For these reasons it does not, at present, seem essential that absorbable materials be used.

The use of a ring external to the vessels, in blood vessel anastomosis, was first suggested by Nitze, at the International Medical Congress, at Moscow, in 1897.⁴

The first actual experiments on record were done by Payr,⁵ in 1900, and the method is generally known by his name. He used rings of magnesium (which is very slowly absorbable in the body), and had very good results: though he did a large number of experiments, he did not give the details of them. Later, he reported one operation on the femoral vein of a man. The vessel was patent three days later when the patient died of pneumonia.

⁴ Centralblat f. Chirurgie, 1897, p. 1042.

⁵ Archiv f. klin. Chirurgie, lxii, 1900, p. 67; lxiv, 1901, p. 726; lxxii, 1904, p. 32.

Jensen,⁶ in 1903, experimented with several methods. His results were slightly in favor of suture methods and may be summarized as follows:—

With Arteries:

	Bone Protheses.	Suture.
Perfect Result.		Two Cases.
Narrowing.	Three Cases.	Three Cases.
Thrombosis.		Seven Cases.

With Veins:

	Various Protheses.	Suture.
Perfect Result.		One Case.
Narrowing.	Two Cases.	Two Cases.
Thrombosis.	Eight Cases.	Four Cases.

Jensen's results, so far as the ring method is concerned, are not conclusive, because he experimented with many different varieties of rings.

The most extensive work with magnesium protheses (or rings) is that of Höpfner, in von Bergmann's Clinic, in 1903.⁷ He used the method altogether twenty-eight times, in different experiments on dogs. Six were simple end-to-end anastomoses. Of these, two thrombosed (both of them with two millimeter rings): while, of the four successful cases, two were with three, and two with five millimeter rings. He also did six reversal or transplantation experiments, with the carotid and femoral arteries. Of these, four were successful; two thrombosed on account of the small size of the vessels. His transplantation experiments with veins all failed. He concludes that the method is not applicable to vessels smaller than three millimeters in diameter.

That blood vessels can be permanently united, by the ring method, is undoubted. Whether this method presents any advantages, excepting its simplicity, over the suture methods, is doubtful, and remains to be determined by further work. The method has been little known and nobody but Höpfner and Payr has used it often enough to become expert at it. The

⁶ Copenhagen. (Quoted from Watts.)

⁷ Archiv f. klin. Chirurgie, lxx, 1903, p. 417.

suture method, on the other hand, has been perfected by a long series of experiments; and the author has had the pleasure of witnessing the finished skill with which Dr. Carrel performs his operations.⁸

One thing, however, is certain,—that for the temporary anastomosis necessary in direct transfusion, the ring method, because of its simplicity, is the method of choice.

Clinical Experiences in Transfusion.—In October, 1907, the author had the opportunity to perform transfusion in two desperate cases of secondary anaemia. While the immediate results were very satisfactory, both cases terminated fatally from continuation of the original diseases.

CASE I.—The first case was one of hemorrhages of obscure etiology. The patient, a German girl of twenty-five years, a trapeze performer, was admitted to the German Hospital, on the medical service of Dr. Morjé, Sept. 26, 1907.

Except that one of her sisters suffered from prolonged and profuse menstruation, there was no indication of any tendency to hemophilia in the family history. Her only previous illness was an attack of acute articular rheumatism, four years before her present trouble. Aside from rather frequent nosebleeds as a young girl, she had never suffered from bleeding of any kind. Her menstruation, which had begun at the age of twelve, was previously perfectly regular and normal, seldom lasted more than two days, and never was profuse. She had never been pregnant, and denied all venereal infection. Her illness dated back fourteen months, to an injury in a trapeze accident. She fell twenty-three meters into a net, and was unconscious; how long, she did not know. From that time on, she had had almost continual bleeding from the vagina. Four months before her admission to the hospital, a curettage had been performed. The bleeding had stopped for three weeks after this, and then had returned and continued. Aside from this, she had suffered, ever since the accident, from

* A careful study of the suture of blood vessels, with special reference to Carrel's work, will be found in an article by Watts, in the Johns Hopkins Medical Bulletin, May, 1907. Watts gives a full Bibliography. Carrel first described his method in the "Lyon Medical," 1902, vol. i, p. 859, and vol. ii, p. 114 and 153, and has published numerous articles since.

very frequent vomiting, which generally came on ten or fifteen minutes after meals. The vomitus was food just eaten and mucus, never blood. For two weeks before admission to the hospital, she had suffered with severe dyspnoea, cardiac pain and palpitation, and a bad cough (with small amounts of mucus sputum, never blood); and her legs had become swollen.

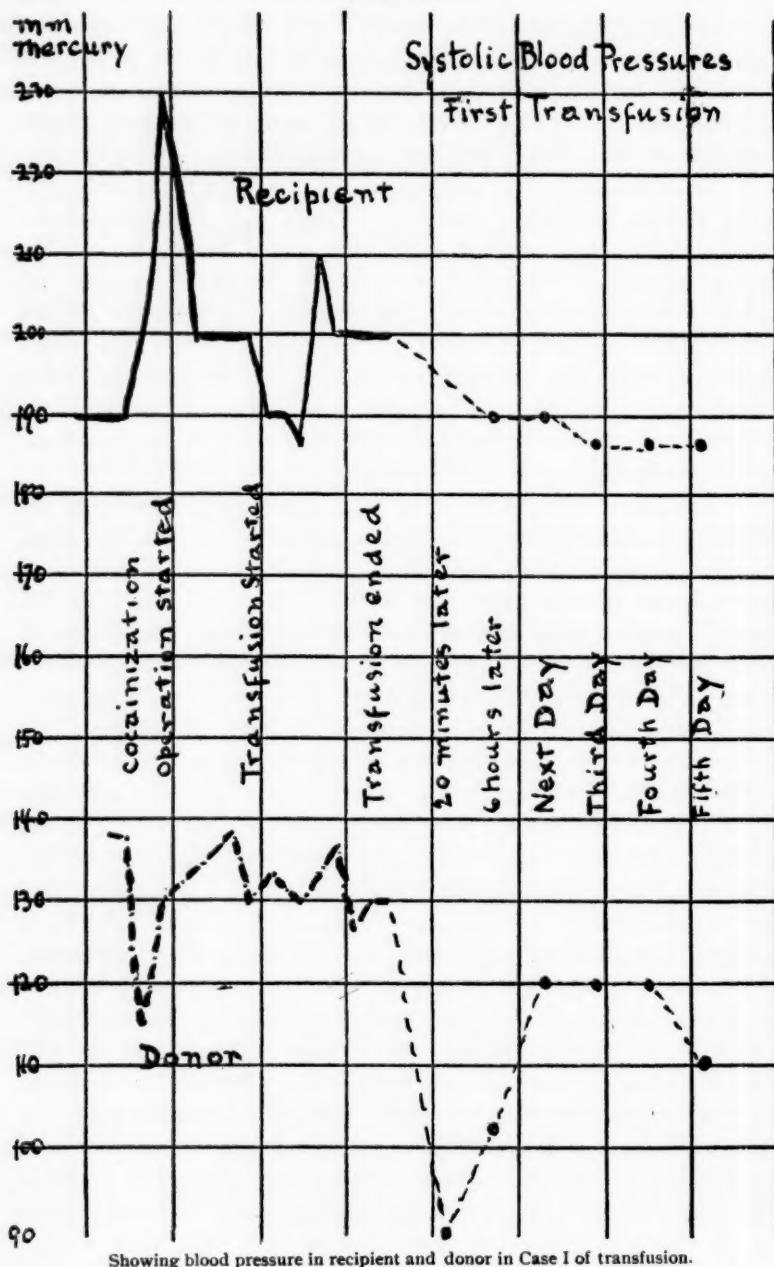
Examination, after admission, showed a very anaemic girl with oedema of the face and legs. There were signs of a bronchitis, and of well marked aortic and mitral insufficiency. The pulse approached the Corrigan type, and the blood pressure was abnormally high (200 mm.). She was bleeding from the vagina. The uterus was firm and freely movable, and there was a tough, cord-like blood clot hanging from the cervix. Ovaries and tubes were normal. Urine examinations were negative, and the blood examination showed a marked secondary anaemia (35 per cent. hemoglobin, 2,350,000 red blood cells).

In spite of every variety of local and general treatment, the bleeding continued, the vomiting became worse, so that the patient had to be supported by hypodermoclysis and rectal feedings, and the anaemia became more and more severe. On Oct. 11th, the patient seemed to be in extremis. She had taken practically no food for several days, and had signs of threatened oedema of the lungs. The hemoglobin had sunk to 15 per cent., and there were only half a million red blood cells to the cubic millimeter.

On Oct. 12, 1907, transfusion was performed. The donor of blood was a healthy girl of twenty-three years, who was paid by the patient's friends. The patient and the girl lay on tables, side by side, their heads in opposite directions. With the coöperation of Dr. F. Torek, the left radial artery of the donor, and the anterior ulnar vein of the patient were exposed, and their central ends united by exactly the same technique described above, for arterial anastomosis. Local anesthesia, by Schleich's infiltration method, was used. (The patient and the girl had had morphine before the operation.) Blood was flowing from the girl into the patient, exactly twenty-five minutes after the first incision.

As soon as the hare-lip clamps were taken off, the vein was seen to distend with blood, and could be felt to pulsate for several inches up the arm. The transfusion was allowed to continue for thirty-five minutes. Then, though both donor and donee were in excellent condition, it was thought best, following Crile's

PLATE III.



advice, to stop. Both vessels were then ligated, the anastomosed segments of vessel cut out, and the wounds closed by suture.

During the course of the transfusion, the condition of the patient improved visibly. Her lips, which had been pallid, became red; her breathing, which had been labored, became easier; her mental condition changed from semi-stupor to almost exhilaration; her blood pressure, which was observed every five minutes throughout the procedure, did not, on the whole, show any marked rise,—probably because it was already pathologically high. (See accompanying chart.)

The next day, the vomiting, which, up to this time had been uncontrollable, stopped. Blood examination, four hours after the transfusion, showed a rise of the hemoglobin from 15 to 35 per cent., and of the red blood cells from 600,000 to 1,096,000 per cubic millimeter.

This increase continued steadily, so that nine days later, the hemoglobin was 45 per cent. and the red blood cells 2,850,000 per cubic millimeter. The explanation of this continued rise in the blood count, after the transfusion, is probably that the total volume of blood was then abnormally high, and that in bringing the total volume back to normal, the body simply got rid of the excessive fluid part, so that the blood became more concentrated.

In spite of this improvement in the general condition, and in spite of every effort of the gynecologists, to whose charge the patient was now transferred, the bleeding from the uterus continued. Very tight packing of the uterus checked the hemorrhage for only a short time. Every other means for treating hemorrhage having been tried without effect, it seemed that in extirpation of the uterus lay the only hope for the patient's life; and accordingly, on Oct. 22nd, ten days after the transfusion, a hysterectomy was performed by Dr. F. Krug. The uterus and adnexa, removed, showed no gross lesions.

The loss of blood was slight, and the patient stood the operation well; but eight hours afterwards, bleeding from the vaginal wound began, and continued slowly, but steadily, until her death. The day after the operation, bleeding from the abdominal wound was noted; the superficial part of the wound was opened by Dr. Seeligman, the blood clots removed, and the wound sutured tightly again. Bleeding from this source then ceased.

Three days after the operation, vomiting commenced again

TRANSFUSION I. BLOOD EXAMINATIONS OF PATIENT.
To illustrate gradual rise in hemoglobin and red blood cells after transfusion.

	September 27.	October 8.	October 12.	October 13.	October 15.	October 17.	October 19.	October 21.	October 30.	(Day before death.)
Hemoglobin	35%	20%	15%	35%	37%	45%	45%	40%	45%	25%
Red blood cells	2,350,000	560,000	600,000	1,096,000	2,064,000	1,744,000	2,220,000	1,840,000	2,850,000	1,500,000
Leucocytes	11,700	9,600	13,000	16,000	...	9,400	...	...	16,400	...
Polynuclear	82%	79½%	88%	91%	...	...	...	...	83%	...
Lymphocyte	14%	16%	10%	8%	...	...	...	...	13½%	...
Mononuclear	1½%	3½%	½%	½%	...	...	...	...	1%	...
Eosinophile	2½%	½%	½%	0%	...	...	...	...	2½%	...
Basophile	0%	0%	1%	½%	...	...	...	...	0%	...
					Microcytes. Poikilocytes. No nucleated red blood cells.					

and from this to the end, the same pernicious type of vomiting persisted; and, as the patient was unable to retain rectal feedings, she received practically no nourishment for the last seven days of her life. This, probably, more than the bleeding, which was not profuse, contributed to the fatal termination. For the last four days of her life, the patient bled from her gums, and the vomitus contained small amounts of blood (probably swallowed). All of the usual means of treating hemorrhagic conditions were of no avail.

At no time was there any evidence of lack of coagulability of the blood. There was no jaundice, no hemoglobinuria, or other symptoms to point to hemolysis.

The patient died on Oct. 31st, nine days after the hysterectomy, and nineteen days after the transfusion.

The effect on the girl, who gave her blood to this patient, should also be noticed. During the transfusion there was no visible change. Her pulse remained strong and slow, and the blood pressure dropped only 12 mm. (see chart). Twenty minutes after the end of the transfusion she suddenly became faint and pale, the blood pressure dropped 40 mm., and the pulse rate slowed to 60.

This condition was transient; but for six or eight hours the patient felt weak. She was able to sit up the next day, and on the fifth day was discharged from the hospital, none the worse for her experience. The change in her blood was small, the red blood cells dropping only from 3,400,000 to 3,000,000 per cubic millimeter, and the hemoglobin from 80 to 72 per cent. She went about and attended to her business, a week after the transfusion.

There was no data to determine the amount of blood lost. This could have been done, either by weighing the donor or patient, before and after the transfusion, or as Watts suggests, by cutting the vein at the termination of transfusion, measuring the amount of blood which flows from the artery through the anastomosis, in a given number of seconds or minutes, and from this, calculating the amount which has flowed in the time taken by the transfusion. (This method, it should be noted, has the error of not taking into account the resistance offered by the venous pressure of the donee.)

The second case in which a transfusion was performed, presented, like the first, so many clinical aspects of interest, that it is hard to refrain from discussing the case in detail.

CASE II.—The patient, a Hungarian, married, 52 years old, and a civil engineer, was admitted to the surgical service of Dr. Kiliani, Oct. 12, 1907. The family and previous history can be disregarded. The patient had never been ill in his life.

For a year and a half he had been suffering, at intervals, with severe epigastric pains, and had been growing progressively weaker. During this time he had lost about forty pounds. For two months he had been vomiting frequently, generally at once after eating. He had never noticed blood in the vomitus.

The principal points in the physical examination were: marked cachectic appearance and emaciation; Argyle-Robertson pupil; Romberg's symptom, and absence of knee jerks; signs of a chronic bronchitis and of arterio-sclerosis; scaphoid abdomen, with marked tenderness and an indistinct mass in the epigastrium.

While in the hospital, the patient vomited, almost daily, large quantities (one to two pints) of altered blood. The vomitus, unexpectedly, turned out to contain considerable amounts of free hydrochloric acid. The stomach contents, too, after a test breakfast, showed free hydrochloric acid 45, total acidity 90. After the vomiting, the patient would feel much relieved for some hours; otherwise, he suffered from constant and severe pain, so that he had to be kept under the influence of opiates almost all the time.

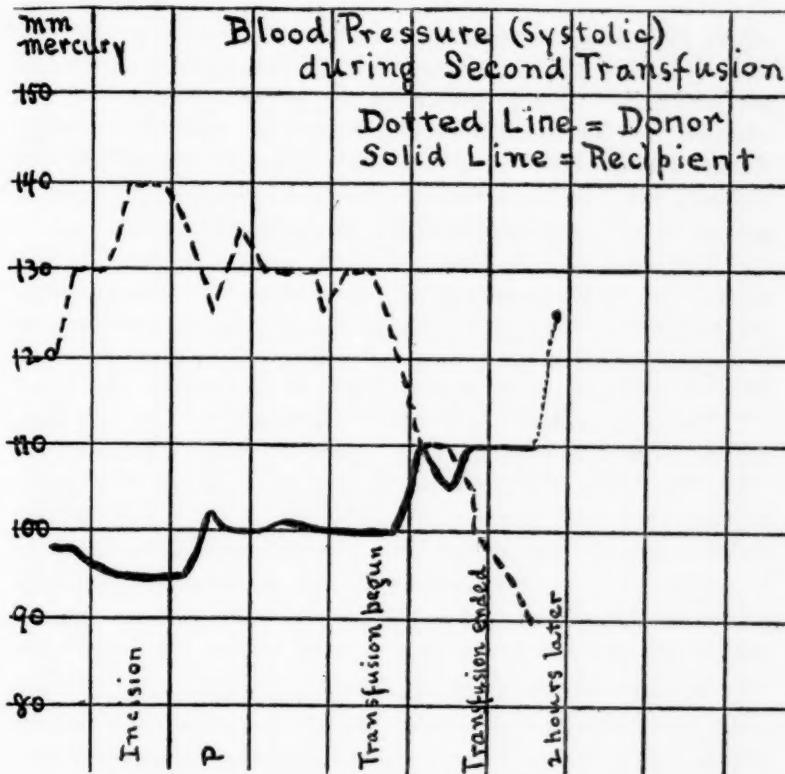
As a result of the constant vomiting of blood, the patient's general condition steadily deteriorated; the red blood cells sank from 2,480,000 to 1,300,000, and the hemoglobin to 20 per cent. The diagnosis was in doubt. Although the acidity of the stomach contents was high, the cachectic appearance and the history of the case, pointed to carcinoma, rather than ulcer, of the pylorus. An exploratory laparotomy seemed indicated; but it was plain, that in the patient's weakened condition, any operation would mean death,—probably on the operating table.

Under these circumstances, a transfusion was thought of, for the purpose of restoring the patient to an operable condition. A ready donor was found in the patient's wife. She was a healthy woman, but undersized, weighing only 90 pounds. On

in this account, the transfusion from her was, at first, thought unwise. But, as she insisted on taking the risk, the operation was performed on Oct. 28th, at 10.30 A.M.

The anastomosis was made by Dr. Kiliani and the author, in the same manner as in the preceding case. Blood was only allowed to run over from wife to husband for 17 minutes. At

PLATE IV.



Showing blood pressure in recipient and donor in Case II of transfusion.

the end of that time, the wife began to look pale and feel weak, and it seemed best to stop.

Even during this short transfusion, the general appearance and condition of the patient improved markedly,—in fact, much more, than the increase of red blood cells to 1,772,000 immediately after, as compared with 1,330,000 per cubic millimeter just before the transfusion, would have led one to expect. The pulse

became stronger, and the blood pressure rose 10 mm. during the transfusion. (See chart.) At the beginning of the transfusion the patient lay weak and depressed, comforted by his wife. After it, the reverse was true, and the patient, whose spirits were almost buoyant, became the comforter. (There is, no doubt, an element of suggestion in this marked mental change, which is described in nearly all cases of transfusion.)

It was considered best to operate at once, before the patient could, by further hemorrhages, lose the blood thus given. At two o'clock of the same day, an exploratory laparotomy was performed. A tumor, involving the lesser curvature of the stomach, and adherent to liver and pancreas, was felt. As the condition appeared to be a hopelessly inoperable carcinoma, the abdomen was closed at once. After the operation, the patient gradually sank, and he died three days later of exhaustion.

Post mortem, was found, near the pylorus, a large, round ulcer, in whose base was seen the patent blood vessel, from which the fatal hemorrhages had taken place. The whole pyloric end of the stomach formed a greatly thickened and indurated mass of carcinoma, which was densely adherent to pancreas and liver.

The wife suffered very little inconvenience, and was discharged from the hospital on the second day. During the transfusion her blood pressure dropped 10 mm. The red blood cells dropped only from 4,400,000 to 4,000,000 after the transfusion, and the change in the hemoglobin was not enough to be measured.

The history of transfusion is a remarkable story of alternate enthusiasm and rejection. It will only be briefly reviewed here.⁹

Though there are many doubtful accounts, there is no clear evidence that any actual transfusion was tried before Harvey's discovery of the circulation of the blood, in 1628. Shortly after this, Christopher Wren¹⁰ first conceived the idea of injections into blood vessels (infusion), and the first experimental transfusions were done on dogs by Richard Lower.¹¹

⁹ The history up to 1875, is fully given in Landois' "Die Transfusion des Blutes," Leipzig, 1875. Köhler, in "Gedenkschrift f. d. verstorbenen Generalstabsarzt v. Leuthold," Berlin, 1906, p. 269, brings the history to 1906, with certain omissions.

¹⁰ Philosophical Transactions, vol. i, 1665, p. 128. (Landois.)

¹¹ Philosophical Transactions, vol. i, 1666, p. 352. (Landois.)

The first transfusion on a human being was done by Jean Denis, in France, 1666. In the years following, transfusion was tried everywhere, with much eagerness and controversy. Some of these transfusions were from animal to man, others from man to man; some of them were direct from vessel to vessel, by means of a cannula; but most of them were indirect; *i.e.*, some sort of pump or container was used. Some successes were reported; but there must have been many failures or fatalities, because the procedure was dropped within a few years, and hardly heard of again for over a century. It was even forbidden by the French government.¹²

In the beginning of the 19th Century, transfusion was again taken up. Blundell¹³ reported seven cases of transfusion of human blood, of which three ended in recovery. Scheele¹⁴ in 1802, and Diefenbach¹⁵ in 1828, wrote extensive reviews of the subject. Dumas and Prevost¹⁶ first showed the injurious effect of the blood of one species on that of another: and most of the transfusions of this period were from man to man. Bischoff,¹⁷ about 1835, introduced defibrination; Diefenbach¹⁸ in his second work on transfusion in 1848, advised defibrination. This method then became the established procedure, and Panum¹⁹ and Brown-Sequard,²⁰ as the result of numerous experiments, both state that it is the main point in successful transfusion.

In the middle of the century, numerous scattered cases were reported; and in 1863, Blasius²¹ collected all the transfusions of the previous forty years,—116 in all, 56 with report of good results. Of these, all were indirect transfusions; only two were from animals (both said to have been successful):

¹² Dorsett, Interstate Med. J., 1906, p. 217.

¹³ Lancet, vol. 9, Oct., 1825.

¹⁴ Copenhagen, 1802.

¹⁵ "Ueber die Transfusion des Blutes," Berlin, 1828.

¹⁶ Ann. de Chimie, 1821, p. 294.

¹⁷ Müller's Archiv, 1835.

¹⁸ Rust, Handbuch der Chirurgie, vol. iv.

¹⁹ Virchow Archiv, xxvii.

²⁰ Journal de la Physiol, 1858.

²¹ Deutsche Klinik, 1863.

and the fourteen cases with undefibrinated human blood, were unsuccessful. Some of the fatal accidents were attributed to air embolism. (Lowenthal²² showed, in 1871, that small amounts of air in the circulation do no harm and are absorbed.)

For the twenty years between Blasius' publication and an important publication of von Bergmann's in 1884, transfusion was a subject of great popular interest as well as of much scientific controversy. Great things were expected of it, and all sorts of exaggerated claims made. It was recklessly tried, not only in anæmia, but in every form of disease. Emerson²³ in one of his essays, refers to it as "the boldest promiser of all,—the transfusion of the blood,—which, in Paris, it is claimed, enables a man to change his blood as often as his linen!"

New and complicated methods were devised, and many cases were described. In the Franco-Prussian war, thirty-seven transfusions of defibrinated human blood were reported, of which thirteen were said to have been successful.²⁴ The books and articles on the subject appearing in this period are very numerous. Geselius²⁵ and Hasse²⁶ reintroduced transfusion from animals to human beings. Lambs blood was generally advised, because its red blood cells were smaller than those of man. The febrile reaction, haemoglobinuria, and other symptoms, which regularly appeared in these cases, were regarded as merely incidental. All these attempts at transfusion of heterogeneous blood were given up, after Landois' discovery²⁷ that the red blood cells are absolutely destroyed and dissolved, when injected into a different species of animal. Ponfick,²⁸ some years later, 1883, in his studies of haemoglobinæmia, gave the explanation of the previously noted symptoms which appeared in heterogeneous transfusions.

²² Berl. Klin. Wochenschr., 1871, No. 47.

²³ "Works and Days," 1870.

²⁴ Köhler, *Loc. cit.*

²⁵ "Zur Thierblut Transfusion beim Menschen," 1874.

²⁶ Arch. f. Path. Anat., vol. 64, 1875, p. 52.

²⁷ "Die Transfusion," Leipzig, 1875.

²⁸ Virchow Archiv., vol. 62.

Panum,²⁹ Landois²⁹ and many others proved, however, that blood may functionate normally, if transfused into an animal of the same species. In one of Panum's experiments, by repeated bleedings of one dog, with transfusions of defibrinated blood of other dogs, he exchanged practically all (over 99 per cent.) of the first dog's blood for that of the other dogs, and yet, the animal remained perfectly healthy.

That defibrination itself, carried dangers, now came to be recognized. Magendie³⁰ had already noted dyspnoea, diarrhoea and bloody exudates in the serous cavities after transfusion of defibrinated blood, and had warned against defibrination. A. Köhler,³¹ in 1877, made the important discovery that intravenous injections of defibrinated blood or of serum, even in animals of identical species, might cause intravascular clotting (multiple thrombosis), because of the introduction of an excess of fibrin ferment. And Cohnheim³² made the authoritative statement that injection of any blood, in which coagulation had already taken place, was an unpardonable error.

These things, together with the general introduction of intravenous infusion of saline solution, about 1875, caused transfusion to be gradually abandoned. And von Bergmann,³³ in 1883, gave transfusion what appeared to be its death sentence. He reviewed the whole subject, and came to the conclusion that the only reason there had not been more fatalities was, that in most cases not enough fibrin ferment had been introduced to produce extensive intravascular clots. He said that the only allowable transfusion was direct, from artery to vein; but that the method was uncertain and cumbersome, and coagulation was likely to occur in the cannula.

From that time, up to the present century, transfusion is scarcely heard of; and writers, who refer to it, even as late as

²⁹ Loc. cit.

³⁰ "Lecons sur le Sang," Paris, 1838.

³¹ "Ueber Thrombose und Transfusion," Dorpat, 1877.

³² "Vorlesungen über algemeine Pathol," vol. i, 1877, p. 346.

³³ "Die Schicksale der Transfusion im letzten Dezenium," Berlin, 1883.

1904³⁴ and 1906,³⁵ all mention it merely as a matter of historic interest, leading up to the introduction of intravenous infusion.³⁶

In the beginning of our century, transfusion may be said to have almost been rediscovered. Von Bergmann had laid down the conditions under which transfusion would be permissible; and, until recently, these conditions were not to be attained.

But, with the recent development of practical means of blood vessel anastomosis, direct arterio-venous transfusion again seemed to come within the realm of possibility. In 1898, Crile,³⁷ in Cleveland, began a series of experiments which he has continued up to the present, and with the most brilliant results.

At first he used suture methods to perform the anastomosis; but more recently, he has adopted the ring method, and has improved it by adding a handle to the ring. He has, experimentally and to some extent clinically, proved that transfusion is the best treatment for every degree of hemorrhage, as well as for surgical shock, and that (with certain possible exceptions to be mentioned later), the transfused blood suffers no impairment, and is a perfect substitute for the lost blood.

Crile has, up to date, reported seventeen clinical cases, of which the results are summarized as follows:

Positive: Acute hemorrhage, pathological hemorrhage (from prolonged jaundice), shock.

Negative: Pernicious anaemia, leukæmia, carcinoma, strychnine poisoning, diphtheria.

Doubtful: Chronic suppuration, tuberculosis, typhoid.

In all his cases, the immediate result was marked improve-

³⁴ De Bruire, Wiener Klinik, xxx, 1904, p. 223.

³⁵ Köhler, "Gedenkschrift, etc." already cited.

³⁶ Küttner, Beiträge z. klin. Chirurgie, 1903, p. 609.

³⁷ Journ. Am. Med. Assoc., 1906, xlvi, p. 1482.

Proceed. Soc. Exper. Biol. and Med. iv, p. 6 and p. 64.

N. Y. Med. Journ., 1907, lxxxvi, p. 145.

Cleveland Med. Journ., 1907, vi, p. 112.

Canada Lancet, 1907, xl, p. 1057.

ANNALS OF SURGERY, 1907, xlvi, p. 329.

ment in the patient's condition, with no injury to the donor. It also seems, from his experimental work, that transfusion will be curative in illuminating gas poisoning.

Recently Watts³⁸ has described four cases of transfusion, by the use of Carrel's suture. In one of these, probably very little blood was transfused, as an occlusive thrombus was found. In the other three cases, the amount of improvement was disappointing; but the cases were very unfavorable.

One point, whose importance has only lately become evident, remains to be discussed.

That the blood of one healthy animal is physiologically interchangeable with that of another healthy animal of the same species, is amply demonstrated. Whether the same is true, if one of the animals be diseased, is still an unsettled question. A recent report of a case of fatal hemolysis after transfusion,³⁹ Crile's and Watt's reports of destruction of red blood cells after transfusion in cases of pernicious anaemia, and the experimental results of Ascoli,⁴⁰ indicate that in some diseased conditions, mixture of blood produces hemolysis.

It is possible, by methods now known, to determine beforehand whether hemolysis is likely to occur when any two given bloods are mixed. Such an examination was made before the second transfusion described in this paper. A thing much to be desired is, that a convenient clinical test for this purpose be devised. A test of this kind, and a better knowledge of the diseases which contraindicate transfusion, should make transfusion one of the safest and most valuable of therapeutic measures.

The author desires to express his thanks to the Department of Physiology of Columbia University, for courtesies extended, to several of the Attendings, and to the House Staff of the German Hospital, for advice and assistance, and to Dr. G. L. Rohdenburg for the photographs presented.

³⁸ Johns Hopkins Bulletin, May, 1907.

³⁹ Pepper and Nisbet, Journ. Am. Med. Assoc., Aug. 3, 1907.

⁴⁰ "Isoagglutinnine and Isolysinne menschlichen Blutes."

Deutsche Med. Wochenschrift, 1901, p. 1239.

ON THE THYMUS GLAND TREATMENT OF CANCER.*

SECOND PAPER.

BY FREDERICK GWYER, M.D.,

OF NEW YORK,

Surgeon to Bellevue Hospital.

ON Wednesday, May 8, 1907, I presented to this society a case of recurrent cancer of the breast which I had been treating with dried thymus gland of the calf.¹ I also at that time mentioned other cases which had been under the same treatment, and gave the methods of preparation of the glands and the modes of administration.

It is my purpose in this paper to give my experiences with the thymus treatment since that time, feeling that my further investigations have, in part, borne out my first impressions concerning it.

If I report so many deaths of patients while under treatment, I would ask you to consider the class of cases with which I have had to deal; also to bear in mind, in estimating the value of the thymus treatment, the utter hopelessness of every case.

With one exception, every case of cancer which I have treated has been considered inoperable, incurable, and hopeless. The exception was a fairly early case of cancer of the breast, sent in to Bellevue for operation, to which I gave thymus for about a week, in doses running as high as one ounce of powdered thymus. There was no result and the patient was operated upon. Most of the cases have had one or more operations, some have been too far advanced for any operation when first seen by the surgeon, and some

* Read before the New York Surgical Society, Wednesday, January 8, 1908.

¹ Reported in the ANNALS OF SURGERY, July, 1907.

have, after operation, had other treatments, such as the X-rays, trypsin, etc., before receiving thymus treatment.

It is natural that I should first take up the history of the case which I presented to you last spring, and bring it to a conclusion.

CASE I.—Mrs. B. *Recurrent cancer of the breast with secondary involvement of the supra- and infraclavicular glands.* (The previous history of this case may be found in the ANNALS OF SURGERY, July, 1907.) Patient of Dr. A. E. Isaacs. At the time of presentation the patient showed very marked improvement in that the glands had almost disappeared, pain was less or absent, and the cachexia was markedly diminished. She had had a period of what I thought to be autointoxication from the breaking down of the cancer masses and absorption of the products, and owing to her temperature and desperate illness the thymus was discontinued for two or three weeks (April 25 to date of presentation, May 8). During that period of no treatment the glands had continued decreasing. Two days after exhibition, May 10, the supraclavicular glands showed a marked increase in size, and while she had not entirely recovered from the illness above mentioned, I did not dare wait longer, so she was again put on thymus. The enlargement continued until the 17th, and was accompanied by general pains of a rheumatic character and by sweating, especially at night, but no fever. One locality of the pain was the spleen, which was found by Dr. Block, who was in attendance, to be slightly enlarged.

The glands subsided by the 23rd to where they were on the 8th, and from that time to the end did not again become larger; on the contrary they would sometimes become so small as to be barely palpable.

Medication was continued until about July 15, with no particular change. The general pains and sweating continued, and she did not seem to gain strength following the acute attack. Thymus treatment was discontinued until she should grow stronger, and she went to the country for ten days, gaining generally a good deal, and feeling much better on her return. The glands were still very small. The heat and humidity in the city were at that time intense and she began to fail rapidly. From July 15 to about October 15, when she died, she received no

thymus. During this period of three months she gradually grew weaker, lost a little flesh, had no appetite, there was no great rise in temperature, the pulse was a little rapid, and she had vague pains located at various but changeable places. Dr. Isaacs, Dr. Block and I saw her at times, but could reach no conclusion as to the cause of her condition. It is worthy of remark that during this time her skin remained clear and the mucous membranes quite red. A few days before she died Dr. Isaacs and I examined her and found the glands barely palpable, with no clinical evidences either externally or internally of other metastases. As no autopsy was permitted, we cannot be positive in the conclusion we reached that the cancer process had been stopped and that her death was due to some other cause. There was an hysterical element to be reckoned with. She had had no thymus for three months before her death, which, in the light of other cases, eliminates that as a cause of death. Cancer cachexia was very slight.

In concluding her history I would ask you to compare her cancer condition preceding treatment with that at the time at her death.

CASE II.—Mrs. F. *Cancer of the pelvis.* Patient of Dr. A. Brothers. The patient had had a very complete removal of the pelvic organs several months before, notwithstanding which there was a recurrence within a few months, and in March her abdomen was reopened by Dr. Brothers, under whose care she came at that time, but there was nothing to be done and the incision was closed, healing kindly. When first seen by me, May 14, 1907, the right leg was $2\frac{3}{4}$ to 3 inches larger than the left, and rectal examination showed a hard, nodular, immovable mass extending nearly across the pelvis, fully so in the left side. The patient had great pain in the leg, groin and pelvis, and had been under morphine in increasing doses for several months. X-rays had been administered from April 22 to May 9 with no effect. She was distinctly hysterical.

Thymus was given and continued to June 17 (34 days), the patient dying on June 30. At each weekly visit the mass showed reduction in size and greater mobility until at the last examination, June 11, the reduction amounted to at least 75 per cent., and the growth was freely movable.

Owing to the reduction in the growth and the decrease in

swelling of the leg, the pains which she still complained of were attributed to the desire for morphine which was very pronounced and uncontrollable.

She contracted pneumonia June 17 and died three days later.

CASE III.—Miss D., aged forty-three. Referred by Dr. J. M. Hitzrot. *Carcinoma of the right breast.*² The patient had undergone two operations and had been treated with X-rays. Recurrence in the breast and in the supraclavicular and neck glands, also in the same glands in the left side of the neck, and in the axillary region. Her right arm was greatly swollen from the shoulder to the fingers and showed venous congestion.

Treatment with thymus was begun May 4, from which time until May 31 there was improvement, as evidenced by reduction of the glands and of the swelling of the arm, and by the better circulation both in the arm and generally. Her skin lost its leaden pallor and became healthier looking, while the mucous membranes were quite red.

From June 1 to October 1 the glands showed but slight change, being sometimes a little smaller and again a little larger, but never so large as when first seen. But small impression was made on the swelling of the arm, which may be accounted for by operative interference with the axillary lymphatics and by the contraction of the cicatrix. I have not seen her since October 1, but she reports that she is growing weaker, although there is no increase in the growth. Medication by thymus is still continued, not with any hope of good results, but at her desire, as she says she feels better while taking it.

CASE IV.—Miss P. Case of Dr. J. D. Bryant. *Carcinoma of the left breast*, of very slow growth. Six operations had been performed, the first three years ago. Slow return after each operation. The last operation took place in March, 1906. Has taken morphine judiciously. Commenced thymus about June 15, continued it until about September 1, a period of nine weeks.

The patient is a most intelligent woman, of charming personality, bearing her trouble with great fortitude and patience, and well able to discuss her case and the results of treatment. On October 30 she gave me her general impressions as follows: At first the pain was relieved in part, appetite improved, strength

²The sixth case mentioned in my previous report.

greater, color better. Toward the last of the medication period pain was greater, appetite not so good, and the thymus was taken with difficulty. During the entire time to October 30 there had been little or no increase in growths and certainly not so much as would have taken place without the thymus treatment. The morphine had been increased, with the consequent nausea and lack of desire for food; the thymus powder was disagreeable to her, and as it showed no marked results it was discontinued.

The patient was seen last on December 4. Her general condition was about the same, with locally a slight increase in one of the growths. Greater pain demanded more morphine. Her color was remarkably good.

CASE V.—T. W. Patient of Dr. L. S. Pilcher. *Carcinoma of cæcum and pelvis.* Operation by another surgeon. Came under Dr. Pilcher's care on May 30. Then had a hard mass in the right lower abdomen the size of an orange, and a sinus surrounded by a cauliflower-like growth. Never complained of pain. Thymus medication from June 2 to 28. On the latter date Dr. Pilcher reported to me that the "Patient was discharged at his own request, no appreciable effect having been observed attributable to the treatment."

CASE VI.—M. B. Patient of Dr. L. S. Pilcher. *Carcinoma of the lower jaw and parotid gland,* starting as an epithelioma of the lower lip six years ago. Two operations. When admitted to the hospital and Dr. Pilcher's care, the patient had a large, general, symmetrical swelling covering the ear and lower jaw region. There was a nodular ulcerating surface within the ear. The eye showed neuro-keratitis and ectropion of the lower lid. Pain was slight. Thymus given from June 3 to 28. Dr. Pilcher reported on the latter date, "No good results noticed from treatment; no bad results noticed from thymus ingestion. Growth steadily increased, as also the pain."

CASE VII.—Dr. McM. Referred by Dr. C. H. Mayo. *Cancer of the pancreas.* On July 9 Dr. Mayo operated, finding a condition precluding removal, and the wound was closed. July 24 patient came to me, when thymus was started and continued to August 17. At first there was an improvement in his general condition; color better, appetite better, and pain much less. After two or three weeks the pain returned as bad as ever, appetite dropped to nothing and he lost weight and strength

rapidly. About August 10 a tumor was palpable in the pancreas region which was not to be felt previously. Patient was advised to return home. Later accounts show a progression of the disease, and he died on December 6, 1907.

CASE VIII.—B. W., aged fifty-one. Referred by Dr. Walton Martin. *Carcinoma of cheek.* First symptom noticed March 15, 1907. Two operations, April 7 and May 18. Referred to me May 27. Examination showed a hard, ulcerating mass in right cheek. The neck glands had been removed and there was no recurrence in that region. Medication by thymus was started.

May 31. There was a reduction in the size of the cheek, the mass was softer, and patient could open his mouth wider.

June 3.—The entire right side of the face was much swollen, reddened, hot and tender. He had a high temperature,—in fact all the symptoms of an acute infection.

June 8.—Office treatment being ineffectual, with Dr. Martin's consent the patient was sent to Bellevue Hospital.

July 15.—The inflammatory condition lasted some time, and under this date Dr. Hartwell reported that the patient was failing rapidly. He died August 16, 1907. The thymus was continued to July 1.

CASE IX.—C. J. R. Referred by Dr. R. J. Scofield. *Carcinoma of the floor of the mouth.* First seen on May 9, 1907. The growth began six months previously. There had been no operation. Examination showed a mass filling the entire right side of the floor of the mouth, bringing it even with the lower teeth, and extending somewhat to the left side. The submaxillary, sublingual, and upper cervical glands were enlarged. The patient was unable to masticate. Medication by thymus started on the same date.

May 15.—Eats solid food, feels better, pain is less, growths smaller. Improvement continued until May 27 when, after an evening of alcoholic excess on the 25th, the growths were found larger and patient was unable to take solid food.

June 7.—The growths were again decreasing in size.

June 10.—The growths were larger and the left submaxillary showed an acute inflammatory condition.

October 3.—From preceding date to this there was continuous and rapid growth of the cancer. Treatment was stopped about September 1, since which time the progress has been more

rapid. The patient was alcoholic, and, notwithstanding instructions to the contrary, continued his drinking during treatment.

CASE X.—J. C., aged 55. *Cancer of rectum.* Case of Dr. J. Prescott Grant. First symptoms two and a half years before. Examined by a physician one year ago, sent to a hospital, but growth was considered too far advanced for operation. Six months ago had a left inguinal colostomy performed. Since then has been more comfortable, but has had constant pain and continued loss of weight and strength. He was passing blood and mucus every hour or so, and had been taking morphine daily for months.

Examination when first seen by Dr. Grant, May 28, 1907, showed a hard ring half an inch above the internal sphincter, completely encircling the bowel. Its surface was covered with hard nodules varying in size from that of a hazelnut to that of a walnut. These nodules extended as far as the finger could reach. The whole growth was exceedingly hard and firmly adherent to the adjacent tissues. The examination was painful and was followed by a discharge of blood. The patient was emaciated and a moderate degree of cachexia was present. There was no enlargement of the spleen or liver, and no glands were palpable.

Thymus was begun May 28, 1907. On the fourth day pain was less severe. At the end of the first week the pain was much less and he had taken no morphine for two days. Discharges were less frequent. There was no change in the local condition.

June 11.—There was somewhat more pain and morphine was recommenced. The discharge was increased. His general condition was improved, the patient having a feeling of well being. The nodules were not so hard.

June 28.—General condition improved, discharges less frequent, nodules softer, smaller, and individual nodules movable on base. The patient's condition, both general and local, now remained unchanged for six weeks.

Two weeks later, August 24, making twelve weeks from the first examination, the growth was found diminished in size, the whole mass somewhat movable, and the nodules soft. There was very little pain and no blood on examination.

Patient passes no blood and the ulcerations are apparently healed. There are no metastases palpable. General condition improved.

At the last examination, two or three weeks ago, the whole growth was found elastic and distinctly movable. There were no hemorrhages, no metastases, and the general condition was better than it was five months ago. The patient now takes morphine occasionally, sometimes going two or three days without a dose. Treatment is being continued.

Dr. Grant tells me that there was absolutely no hope from operation when treatment was begun, but he now feels that, if the patient continues to improve generally, an operation would be feasible and advisable.

CASE XI.—Mrs. L., aged sixty-nine. *Carcinoma of breast.*
Case of Dr. A. E. Isaacs.

June 12, 1907.—Recently noticed a mass in the left breast the size of a hazelnut, not painful. The lymphatic glands of both supraclavicular regions were enlarged, those in the left side being the larger. The largest glands were the size of a small hazelnut. Weight 149 pounds. No cachexia. Vague history of rheumatism.

June 24.—Treatment with thymus begun.

July 1.—Breast mass larger, supraclavicular glands on left side about the same, on the right side much smaller.

July 29.—Until this date patient felt better and had better appetite. Breast mass showed continued decrease in size, with disappearance of secondary infiltration. The supraclavicular glands on both sides grew gradually smaller and softer. Constipated.

August 5.—Feels pain. Breast mass the same. Supraclavicular glands harder and the right larger.

November 11.—Since August 5 the local conditions have alternated; at one time the masses would be smaller, at another larger; generally speaking, they were no larger than when treatment was begun, five months ago. Her general condition was better and there had been no extension of the process to other glands.

December 9.—Dr. Isaacs writes me that during the last month the patient had failed in every way. The growths were all larger, she was losing flesh, and a marked difficulty in breathing made him think of possible mediastinal metastasis, or pressure on the recurrent laryngeal due to increased size of the deeper neck glands.

He says that notwithstanding the present comparatively poor report, the condition of the original glands is such that were they as they now are when he first saw the patient, he would have offered operation. While, when first seen they were matted together forming masses, now each gland is separate and very freely movable.

CASE XII.—O'C. *Cancer of tongue.* Patient of Dr. John Rogers.

First appearance of growth in August, 1906. Two operations, the second for involvement of the tonsil.

May 15, 1907, when thymus was begun, there was suppuration in the mouth and two or three sinuses in the cheek and beneath the jaw, externally, with a good deal of discharge. The neck glands were involved in the growth and in the ulcerations.

June 15.—Thymus was continued to this date, the patient dying soon after, I believe of pneumonia.

Dr. Rogers reports that pain was relieved in part, the suppuration lessened, and for a while the growth was held in check.

CASE XIII.—H. H., aged fifty-eight. *Cancer of pleura.* Case of Dr. W. L. Niles. Cancer history in family. Mother died of cancer of the intestines. Wife had two operations for cancer of the breast, now apparently cured. Rheumatic history.

First symptoms July, 1905. First seen by Dr. Niles October 21, 1907. Diagnosis of epithelioma or endothelioma of pleura was made on October 26, 1907, and confirmed by Dr. W. G. Thompson.

Chest aspirated October 26, and twelve ounces of reddish-brown fluid withdrawn. October 31 thirteen ounces of fluid of the same character.

November 5.—Thymus started. Up to this time the patient was getting worse very rapidly, had very severe pain, took only fluids, and at times was slightly delirious.

November 14.—Improved to this date. Less pain, good appetite, mind clear.

November 15.—Chest filled with fluid very rapidly and his condition again became extreme, and it did not seem possible that he could live twenty-four hours. Thymus stopped.

November 17.—Thymus again started.

December 7.—Since November 17 condition has gradually improved till this date, except emaciation and anæmia, which

have progressed. He has little pain, eats well, mind is active and clear and he sits up in a chair. His general condition was so good that he was permitted to return to his home in Philadelphia.

Dr. Niles sends me the following with his synopsis of the history: "It is my opinion that since using the thymus the new growths have not increased in size and in the cervical region they appear to have diminished. He has had less pain, a better appetite and clearer mentality. Emaciation and anaemia have, however, progressed."

CASE XIV.—J. S. *Carcinoma of the uterus.* Referred by Dr. R. J. Scofield. When first seen by me, May 2, the growth seemed localized to the cervix, but at operation on May 4 the lymphatics were found so affected that, although a complete removal of all the appendages was made, a prognosis of further growth was given Dr. Scofield and the family. The patient was to report to me at the first sign of recurrence.

October 11 she returned, and examination showed a mass low down in the pelvis, extending from the left anterior superior spine to two or three inches beyond the middle line. It was irregularly nodular, hard, and immovable. There was evidence of ulceration in the vagina, and a discharge at times bloody; and swelling of the legs, the right showing the most. There was sharp, cutting, almost continuous pain, and the patient had lost weight rapidly. On her first visit she was almost too weak to travel. Dr. Scofield told me the growth had appeared only recently and had advanced with great rapidity. Thymus was started.

December 12.—Without giving details of her progress, it may be stated that except for occasional setbacks for a few days, she has improved both generally and locally. The growth is half the size it was, there is less discharge, much less pain, her weight is within two pounds of what it was on October 11, her appetite is good, her color is good, and she is much stronger. Treatment has been interfered with at times by a temperature which would reach 102°. She is now running an afternoon temperature of 99° to 100°.

CASE XV.—M. G. *Carcinoma of the intestines and peritoneum.* Admitted to Bellevue Hospital May 11, 1907. First symptoms six months previous to admission. Examination

showed a hard, irregular mass filling the lower abdomen. On rectal examination the mass was found to fill the entire inlet of the pelvis. There was no ascites and no pain.

May 15.—Thymus medication started and continued until May 26. At first patient was more comfortable and felt generally better. Later his abdomen became distended with fluid, and on May 26 sixty-two and a half ounces of fluid were withdrawn. Palpation showed a decided reduction in the growth.

June 4.—Soon after the tapping, the abdomen again filled, the patient became rapidly weaker and he died on this date.

Dr. Frink, the house surgeon, is quite positive that the mass had become very much smaller and much more movable.

CASE XVI.—A. S., aged sixty-six. *Carcinoma of rectum.* First symptoms six months before.

May 3.—Admitted to the surgical service. Examination showed a well-marked growth including the entire circumference of the rectum, firmly fixed, and the lumen so small that it would not admit the little finger. The surface was ulcerating. Examination was painful and followed by blood. The patient complained of great pain and said she habitually passed blood with the stools. She had been under observation in the medical wards for several days and had received frequent doses of morphine to relieve the pain. Thymus medication started.

June 25.—Patient asked for her discharge. The thymus was continued to this date. Several examinations of the rectum were made and at each the mass appeared smaller, softer, less fixed, more movable, and not so painful. The lumen increased so, either from reduction or from ulceration, that the index finger was very freely admitted. Pain was so relieved that I find but nine doses of morphine were administered during this time. I am informed by Dr. Frink, the house surgeon, that most of the time she was up in a chair, and when she left the hospital her general and local conditions were much improved.

In addition to the cases reported, a number of cases were under treatment for a few days only. These I have omitted as they would be of no help in forming opinions. Other cases have been treated under conditions which prevent my presenting sufficient history. Others have been under treatment but a week or two. Of the latter I can say that all

THYMUS GLAND TREATMENT OF CANCER.

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No.	Patient	Referred by	Locality	Operations	Duration	Treatment	Duration	Termination	Results
					previous to treatment				
1	Mrs. B.	Dr. A. E. Isaacs	Breast; return in supraclavicular glands.	# 8 yrs.; 1 yr. since last operation	April 1, '07	3-½ mos.	Death	No treatment for 3 mos. preceding death. At time of death glands barely perceptible, no other metastases, cachexia not nearly so marked as before treatment. No swelling of arm remaining.	
2	Mrs. F.	Dr. A. Brothers	Pelvic organs.	2 May 14, '07	34 days*	Death	Growth reduced 75%; movable, swelling in leg diminished.		
3	Miss D.	Dr. J. M. Hitler	Right breast; return in breast and supraclavicular glands, both sides.	2 May 4, '07	Continues	.....	Swelling of arm continues. Breast about same. Lymphatics same or smaller. No other metastases. Cachexia at first less, later returned	
4	Miss P.	Dr. J. D. Bryant	Cecum and Pelvis	6 4 yrs.	June 15, '07	9 weeks	.....	General condition about same-no better. Locally slight growth in gland. No new ones showing. Pain greater. Color remarkably good. No results.
5	T. W.	Dr. L. S. Pilcher	Lower jaw and pancreatic gland.	1# 6 yrs.	June 2, '07	26 days	Death	No result except temporary general improvement.	
6	M. B.	Dr. C. H. Mayo	Pancreas	1# 6 yrs.	June 3, '07	25 days	Death	An acute infection developed. No results from treatment.	
7	Dr. McM.	Dr. W. Martin	Chest	2 2-½ mos.	May 27, '07	33 days	.....	Temporary improvement during first week of treatment. General condition improved. Growth smaller, movable, no discharge, no metastases.
8	B. W.	Dr. R. J. Scofield	Floor of mouth	6 mos.	May 9, '07	15 weeks	.....	Better until the last month. Now both local and general conditions as bad or worse than at beginning of treatment. Glands remain discrete.
9	C. J. R.	Dr. J. C. Grant	Rectum	1** 2-½ yrs.	May 28, '07	6 mos.	Death	Temporary control of growth, and pain partly relieved.	
10	J. C.	Dr. A. E. Isaacs	Breast	.....	June 24, '07	5-½ mos.	.....	No increase in size, cervical glands smaller, less pain, better appetite, clearer mentality.
11	Mrs. L.	Dr. John Rogers	Tongue	2 1-½ yrs.	May 15, '07	1 mo.	Death	Emaciation and anemia increased.	
12	O'C.	Dr. W. L. Niles	Pleura	2-½ yrs.	Nov. 5, '07	32 days	.....	Improvement locally and generally. Tumor reduced one half, less pain, more strength.
13	H. H.	Dr. R. J. Scofield	Pelvis	3-½ mos.	Oct. 11, '07	Continues	.....	Tumor reduced in size and more movable.
14	J. S.	Bellevue	Peritoneum	6 mos.	May 15, '07	11 days	Death	Tumor smaller and more movable. General condition better.	
15	M. G.	Bellevue	Rectum	6 mos.	May 3, '07	22 days	.....	.....

*Exploratory

**Colostomy

show the improvement at the beginning which the reported cases show.

Besides cancer, I have treated a few cases of some other conditions in pursuance of the suggestion contained in my first paper that thymus might be applicable to diseases other than cancer. I will say no more at this time than that the cases so treated seem to bear out my previous statement.

The foregoing histories of cancer cases present several prominent points, *viz.*:

1. With the exception of two or three cases, all showed temporary improvement in that there was

- a.* Less pain,
- b.* Reduction in growth,
- c.* General condition better.

This improvement was quite prompt in making its appearance.

2. Several of the patients died or at present writing are near their end.

3. Many of those that died did not succumb as the cancer patient ordinarily does, in that:

- a.* There was no great loss of weight,
- b.* No leaden pallor and other visible signs of cachexia,
- c.* No local increase of the cancer.

On the other hand, at least two of the fatal cases continued fairly well nourished, with clear skin, red mucous membranes, and an actual and marked reduction of the cancer growth, with no evidence of metastases. The same is true of some still living.

4. The deaths were rather peculiar, and must be attributed to one of three causes:

- (1) Progression of the cancer,
- (2) Effects of the thymus treatment,
- (3) Effects of some substance set free by the thymus medication which was not eliminated.

That the fatalities were not due to the first, I can only say that clinical evidences pointing to a progression of the

cancer process were not present, and I am inclined to believe growth and extension had been stopped.

That deaths were due to the thymus treatment directly, I think can be negatively answered by the fact that:

(1) Treatment in some cases had been discontinued for a long period previous to death; in case I for three months.

(2) That other cases, still living, have taken thymus for much longer periods, in as heavy doses, and some are, if anything, holding their own or improving. (See cases III, X, XIV.)

On the other hand, it is possible that the continued use of the thymus has caused the formation of an antibody of such toxicity, persistency and quantity as to cause the condition preceding death.

That the deaths, in some instances, of those having had thymus treatment, may be due to a liberation of some toxic material which is not eliminated, I believe to be possible and fairly probable. This material, added to the constitutional condition which favored or gave rise to the growth of the cancer, was more than the system could stand. I have recognized this as a possible danger and even in my first paper mentioned the great importance of elimination.

The cases may be divided for the purposes of study, and for indications as to the method of administration of the thymus, into two classes:

- (1) Cancer in or near the digestive organs,
- (2) Cancer not involving the digestive organs.

Illustrative of the first group are the cases of cancer of the cheek (Case VIII), that of the floor of the mouth (Case IX), and that of the pancreas (Case VII). In none of these was the disease checked to any great extent, and the results were the most discouraging of the lot. I attribute the difference in action of the treatment in this class as compared with Class II, to the action of the digestive juices on the thymus powder, and the distinct interference with proper nourishment and assimilation.

The cases of abdominal cancer in a man (Case XV),

and one of the two recurrent cancers in the pelvis (Case II), showed a very rapid reduction with no extension of the growth and rather rapid termination as compared with, for instance, the two cancers of the rectum (Cases X and XVI), which were slower in reduction and one of which, after several months' treatment, is still gaining.

The cases of recurrence of cancer of the breast were still slower in showing effects of treatment and the effects have been more permanent.

All of the cases of the second class showed uniformly a reduction in the growths which did not again enlarge to the size before treatment, and in none of these was there any clinical evidence that metastatic growths had formed since treatment was begun.

The thymus medication has consisted mainly in the administration of the dried gland in powder form. One of the cases received the watery extract of the gland containing nucleo-proteids and other products (prepared practically as reported in my previous paper), given by mouth for a while. Several received the same watery extract hypodermically. The usual dose was one to two drams by weight of the powder three times a day, or the equivalent of one dose hypodermically once a day. I found no advantage in larger doses and but slight results from smaller ones.

The plan I have recently followed, and the one I think best at this writing, is to give the extract hypodermically to cases of cancer in or near the digestive organs, and to give the powder to all others. No difference was noticed in the action, whether given in powder or extract. The hypodermic administration is somewhat painful but never has caused more than a passing redness where injected. I repeat, its use should be limited to cases of cancer in or near digestive organs.

I realize that the thymus treatment has not yet in itself proved curative, and in the search for the necessary adjunct I will mention that I have tried change of climate, getting a temporary improvement in dryer, cooler air than New York

furnished last summer; modifications and limitations in diet, having tried an all-milk diet, a no-milk diet, and at present am trying a diet free from starches and sugars. Neither the all-milk diet nor the no-milk diet seemed to give any particular result. The diet free from starches and sugars is not yet tried out.

I have also tried several drugs in conjunction with the thymus, notably potassium iodide, carbonate of soda, bicarbonate of soda, etc. I am now using the acetate of soda in doses averaging gr. 30, t.i.d., with an idea of eliminating by the kidneys as well as increasing alkalinity. I think there is an undoubted lessened alkalinity of the blood in cancer and it has been my endeavor to increase the alkalinity and oxygen carrying power of the blood, and to promote elimination. I would reiterate the necessity for elimination in every possible way,—by the skin, the bowels, and the kidneys.

Whether it be a drug such as one of the above, whether it be some organic substance other than thymus, or whether it be some special part of the thymus, which is wanting to form the second step in the successful treatment of cancer, I cannot but feel that thymus will be found to be part of the finally accepted treatment.

One can well imagine that with so complex a disease as cancer, it may be a combination of remedies rather than one which eventually gives us control of the disease. On the other hand, it may be one or more of the several constituents of the thymus which are necessary, the others acting either as retarders or actually as antagonists. I have spent a great deal of time trying to separate the different constituents, but owing probably to lack of technical training in physiological chemistry I have failed as yet to produce anything more effectual than the watery extract.

I have been asked why I have not treated cases that were more favorable. I have felt that the best work could be done with advanced cases, and my supply of thymus was so limited that I could not well take more cases. I think all cases admitting of operation should have one, and that

at present there is no remedy which offers so much chance for cure as the knife. The value of thymus will be found in the treatment of cases after an unsatisfactory operation; I mean those cases in which at the time of operation we feel we have not eradicated the entire disease. Inoperable and advanced cases will, I think, be benefitted, their lives prolonged and made endurable, and some such may be so benefitted and the local condition so improved that an operation may be rendered feasible.

The last observation I wish to record has to do with the lasting effects of the treatment. It would seem from my records that either the action of the thymus continues for a fairly long time, or it so alters constitutional conditions that the tendency to growth is stopped. The advantage of this observation will be found in treating post-operative cases which present nothing by which we may judge our progress. That is, it would point to periods of treatment with shorter or longer intervals between.

I would take this opportunity of thanking those sending me cases and those giving the treatment a trial and furnishing me reports of their cases. I would also thank Dr. S. P. Beebe for help from his writings and conversations, Mr. Fetterly of Swift & Co., for facilitating my getting the thymus glands in proper condition, and Mr. H. A. Gardner, of Providence, R. I., for laboratory help.

THE PARATHYROID GLANDS.

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HISTOLOGY.—In 1880 Sandstrom discovered a pair of small glandular masses lying in close relation to the posterior part of each lateral lobe of the thyroid gland. These he named the parathyroid glands.

These parathyroid glands are small reddish-brown or yellowish-brown ductless organs. Most of the glands are of the reddish-brown color, due to the rich blood supply. When the gland assumes the yellowish tint it is because of the amount of fat that it contains. Of thirty-seven glands observed only one was of the yellowish hue. They are flattened antero-posteriorly and the long diameter is generally in the superio-inferior direction. They are somewhat bean shaped or better still kidney shaped with a sort of a hilum where the artery enters. In size they vary greatly. The average long diameter is one-quarter of an inch while in width we have an average of one-eighth of an inch and the thickness of one-eighth of an inch. They range in size in the long diameter from one-sixteenth to seven-sixteenths of an inch.

Each gland is composed of solid irregular masses of epithelium like cells arranged in columns. These columns of cells anastomose with one another. Numerous blood-vessels are seen between the individual columns, but there are none between the individual cells. The parathyroid is absolutely different from the thyroid and is not like an accessory thyroid. The latter are always of thyroid tissue. Lymph follicles have been found in the parathyroid glands. Each parathyroid has a separate and distinct capsule similar to that of the thyroid but very much thinner. Wherever this gland may be found it is always within its own capsule. The capsule itself may be

intimately connected with the thyroid capsule, but the substance of the gland never has any outside connections. This capsule sends off septa that separate and support the cell columns. There are no septa between the individual cells.

Gley thought that the parathyroids represented embryonic portions of the thyroid. Later and after more extended study he proved that they were of their own kind, that is, not like any other gland. Pienant finds them similar in appearance and structure to the carotid bodies. Welsh considers that they resemble the anterior lobe of the pituitary body more than they do the suprarenal glands, as claimed by Richardson, and that they are unlike thyroid tissue. MacCallum and all recent writers are agreed that these organs are separate and distinct glands and have a different function than the thyroid gland.

Number.—Four is the usual number of parathyroids in the human body. There may be as many as five or only one can be found. Because of their small size and the variety of location one may overlook them. Another factor that makes them difficult to find is the yellowish color, which so resembles fat that they are passed over as fat globules. Again the brownish ones so resemble muscle that when dissecting the thyroid free from its surrounding structures a small piece of muscle may be taken for the gland. A lobule of fat that is bruised, that is, slight bleeding has taken place in it, is very similar to the parathyroid. The difference can be told by touch for the gland gives a peculiar hard feel that the fat lobule does not give even when filled with blood.

Although the number four gives an anatomical symmetrical classification this arrangement is found wanting in over 25 per cent. of the cases. Berkeley found but 2.5 glands to the person in 125 autopsies. Pool 2.9 in sixteen thyroids examined. In twelve subjects that I examined I found thirty-seven parathyroids or $3\frac{1}{12}$ glands to the person. It is claimed that the superior are more constant in number but my findings have been: superior seventeen and inferior twenty. Of course, a greater number may change this proportion. It is also claimed that if there is only one parathyroid found it is the

superior. I cannot prove this from my dissections for I never found less than two to a person. I have been unable to find more than four to a subject although the fifth one has been found a number of times. This fifth gland is usually some distance from the thyroid itself.

Location.—The parathyroid glands are generally located on the posterior surface of the capsule of the thyroid gland. They are outside of the capsule and closely adherent to its surface. Thirty-four of the thirty-seven parathyroids found were on or adherent to the posterior surface of the capsule of the thyroid. Inside the capsule of the thyroid I found one, and some have been found on the anterior surface of its isthmus.

The superiors are generally located on a level with the cricoid cartilage. Or on the level of that space between the cricoid and the upper margin of the isthmus of the thyroid. The superiors may be found anywhere from the level of the lower border of the isthmus to the summit of the lobe. Occasionally a parathyroid is found above the thyroid. The thyroid gland wrapping itself about the trachea has its lateral lobes in relation to the trachea and the cesophagus. Now in one-third of the cases the parathyroid will be found in relation to the above mentioned structures at their junction. The superior may be found below the isthmus of the thyroid. This is rare. I found it once. These two superiors are called internal because they are generally located on the posterior-internal surface of the thyroid. They are more constant in position for when they are present they will be found in that limited area of the upper two-thirds of the posterior surface of the thyroid gland.

The two inferior or external bodies are more varied in their location. They are called external for the reason of their being further away from the median line than the superiors. Also from their location on the posterio-external surface of the lateral lobe. The usual location is at or within one-half inch of the lowest part of the lobe of the thyroid gland. It may be found either anterior or posterior to the recurrent

laryngeal nerve. When one is found posterior to the nerve it is usually the left. Its relation to the inferior thyroid artery is inferior to the branches that pass to the posterior surface of the thyroid. In only one instance did I find a parathyroid gland above the inferior artery. It is always close to the artery. The parathyroid may be just below the thyroid or some distance from it. Even on or in the substance of the thymus gland they have been found. It is not rare to find one just within the thorax. The lower parathyroids are more difficult to find for the following reasons: First, they are not in so close a relation to the posterior capsule of the thyroid; second, often in the loose fat just below the gland; third, because there is more fat here than around the location of the superiors; fourth, the inferior are somewhat smaller than the superior. Evans found that six out of nineteen inferior parathyroids were below the gland, but considers it unique to have this great proportion. I found but two out of twenty below the gland.

When the four are found it is always a superior and an inferior to each lateral lobe of the thyroid. With three the arrangement may be two superior and one inferior or vice versa. Given but two glands the usual positions are an inferior and a superior. Four had this placing while one had two inferior parathyroids, one being on each lateral lobe. They may be on the same lobe or one on each lobe. I found them three times on the same lobe while in two other specimens the arrangement was one on each lobe. This was the placing in the five times that I found but two parathyroids to the person. I can find no statistics bearing on this point.

The Blood-Supply.—The parathyroid glands are always supplied by a special parathyroid artery. This artery supplies the gland itself and nothing else. It is always a direct and separate branch of the thyroid arteries or one of their main divisions. At times two or more arteries are seen running to the gland but only one enters the gland. The others supply the fat around the gland. This parathyroid artery enters a hilus in the gland. When the parathyroid is adherent to or within the capsule of the thyroid, the capsules have an arterial

anastomosis. This anastomosis ends with the capsules, there never being any communication with the gland itself.

In about 50 per cent. of the cases there is a large anastomosis on the posterior surface of the capsule of the thyroid, formed by the two arteries on the same side. This has been termed the channel. This arterial anastomotic channel is formed by the superior and inferior thyroid arteries of that side of the neck only. It runs along the posterior surface of a lateral lobe and generally near the mesial border. Its formation is usually as follows: The superior thyroid artery divides into two main divisions when it reaches the thyroid gland. One we will call internal, *i.e.*, nearer the medial lobe, the other external. The inferior thyroid artery on reaching the gland divides into two or three main branches. We will call these internal, middle and external as per the arrangement given for the superior. Either the internal or the external of the superior anastomoses with internal or middle of the inferior artery to form the channel. It is very uncommon to find the external division of the inferior forming the channel. The usual arrangement is for the two internals to form this channel, which I found in thirteen of the twenty-four specimens examined.

The inferior parathyroid artery is always a branch of the inferior thyroid artery or of the channel of anastomosis. The superior parathyroid artery may be a branch of the superior thyroid artery. Pool states that it is always supplied by the superior thyroid artery. This statement does not follow my observations. The supply was always from a direct branch of the inferior thyroid artery or from the channel. Even when from the channel, the angle of direction of the artery, is such, as to lead one to the conclusion that the blood comes from the inferior artery. In the seventeen superior parathyroid glands found none got their artery from the superior thyroid. Therefore, it would seem, from this, that it is extremely rare for these upper glands to be supplied from the superior thyroid artery. When the parathyroid artery does not come from the channel it most often comes from either one of the two internal branches of the inferior artery.

In three specimens the parathyroid artery was found a direct branch of the inferior thyroid artery. As seen in Fig. 1 the parathyroid artery arose from near the thyroid axis. This was three inches long. It is very frequent that the superior and inferior glands are supplied by the same division of the inferior thyroid artery. It is of great importance to note, that at times the two internal divisions of the inferior thyroid artery anastomose across the isthmus of the thyroid gland. This is of prime surgical importance as will be shown below. Twice the oesophageal artery of the inferior thyroid gave off the inferior parathyroid artery. This is another important point in the operations and their results. The parathyroid artery may also be a branch of one of the main muscular thyroid arteries.

Results of Injury to the Parathyroid Glands.—Although we have no exact knowledge of the functions of these glands we must now recognize them, preserve them and keep their blood-supply inviolate. That there is a function we have no further reason to doubt.

It has been shown by Gley, Vassalé and Generali that when the parathyroid glands are removed in dogs death results in about three days of a generalized tetany. Destruction of the thyroid alone produces disturbances of metabolism, which appear slowly, and gradually lead to myxedema. Destruction of the parathyroids alone produces acute, rapid, fatal nervous phenomena, that is, tetany. This tetany is of central nervous origin. The tetany can be relieved for a short time by bleeding and transfusion of saline into the veins. This would lead one to believe that there was a toxin in the blood. Feeding of the parathyroid gland does not stop death. All recent writers agree that tetany and death must result from the removal of all the parathyroids. The destruction of their blood-supply causes the same fatal result.

In the great majority of cases the tetany following operation for the removal of all or part of the thyroid gland, is not due to the removal of the parathyroids themselves. It is due to the destruction of their blood-supply. This is a well proved

fact. In the numerous thyroids examined after operative removal few parathyroids have been found. Therefore the tetany following must have been caused by the cutting off of the blood-supply of the remaining gland or glands. Halsted states that tetany results even from the ligation of but one thyroid artery. This fact is proved in one of my specimens, as per Fig. 5, if the inferior thyroid were tied the only two glands would lose their blood-supply and therefore be destroyed. This would also result in the case as shown in Fig. 7. Kocher directs that two arteries should never be tied at one sitting and that never more than one-half of the thyroid gland should be removed except for some special reason. The same specimens give great weight to his dictum.

The Surgical Saving of the Parathyroid Glands.—I believe that, with a proper operation and careful dissection, the whole thyroid gland can be removed without causing tetany. The essential thing in the operation is to recognize the parathyroid glands and their blood-vessels. Neither of these must be injured.

The operation is as follows: Make the collar incision and reflect upward the skin for one-half inch and then make a similar incision in the platysma muscle superior to that of the skin. All vessels that bleed ever so little must be at once clamped. This rule must be followed throughout the operation as staining of the field with blood is fatal to a good dissection. It also increases the difficulty in locating the parathyroids. Reflect this skin-muscle flap well above the summit of the thyroid. Now make a mid-line vertical incision through the fascia only deep enough to enable one to raise the sterno-hyoid and omo-hyoid muscles. Raise these muscles and put two clamps on them as near the hyoid bone as possible, cut between the clamps and do not remove same till ready to suture muscles (Mayo). Clamp and cut the sterno-thyroid muscle separately thereby saving bleeding and giving more room by being able to retract the two former muscles more freely (Halsted). The sterno-thyroid muscle is a very vascular muscle and being well spread out over the thyroid gland is diffi-

cult to separate and retract without free bleeding therefore Halsted's plan is excellent. All severed muscles now being strongly retracted you raise the lobe from its bed. Be careful not to tear the delicate blood-vessels entering it. Now grasp the upper pole with the fingers and make traction forward and in towards the median line. This brings the superior thyroid vessels that enter the gland into view. Working now from the external superior border of the gland and towards the median line clamp all vessels as they enter the gland. Clamp these vessels as close to the gland as possible. It is not necessary to clamp on the gland side as the traction put on the lobe stops oozing. Cut between the clamp and the gland. By this method of clamping and cutting the freeing of the upper pole is easy and there is slight danger of injury to the superior parathyroid. With the upper pole free draw a little more downward and inward so to put the inferior thyroid artery branches on the stretch. Clamp these as they enter the gland. Be careful of too much pressure on the trachea. Intermittent traction from now on is better. This shortly brings into view the two or three main branches of the artery. As this vessel is tortuous, the traction made straightens the artery and the lobe can be turned so as to expose its posterior surface. The parathyroid should be found and its artery traced to its source. Clamp the thyroid branch distal to this source. The other one or two divisions may now be clamped with impunity. This frees the whole lobe and the recurrent laryngeal nerve is seen and thus avoided. Halsted after bringing into view the inferior thyroid vessels notes where they enter the gland. He plunges a sharp pointed clamp into the substance of the gland at this point seizing the vessels. Cutting distal to this frees the gland and saves the blood-supply of the parathyroids. Either method is safe.

There can be shown a number of important surgical points from the specimens that I have. Fig. 1, the older operation of complete removal of the thyroid could have been successfully done. The left inferior parathyroid not injured on account of its artery arising from the main trunk of the



The parathyroid glands and their vascular supply.

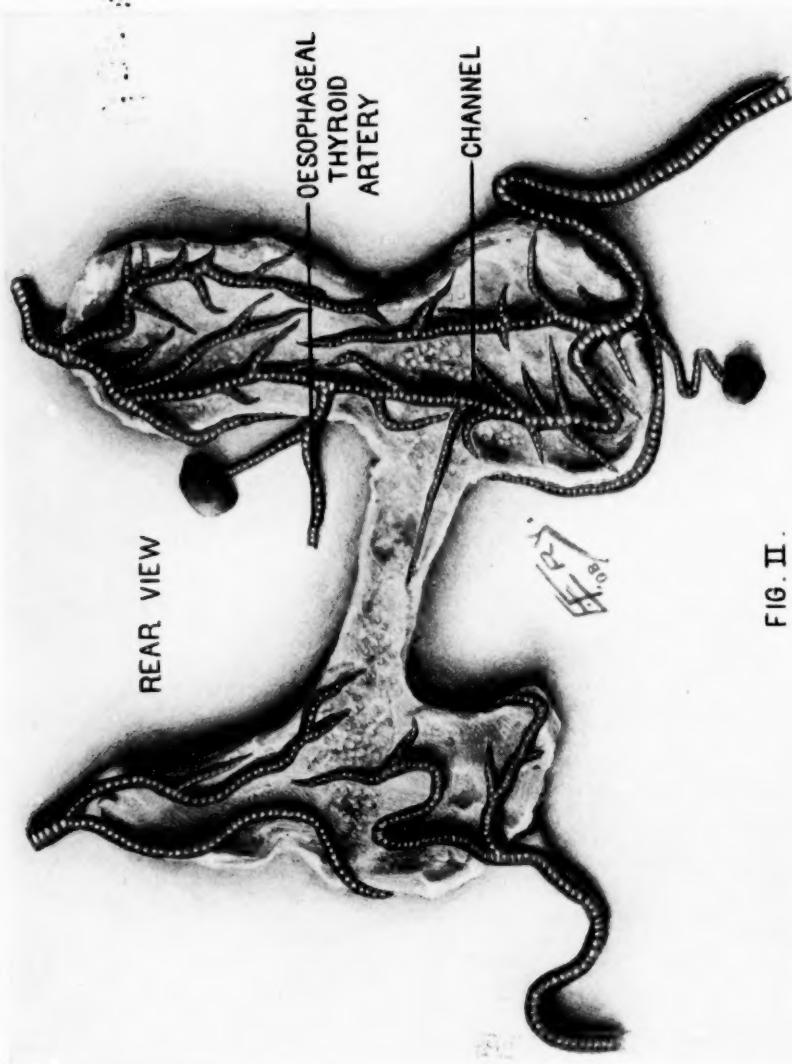
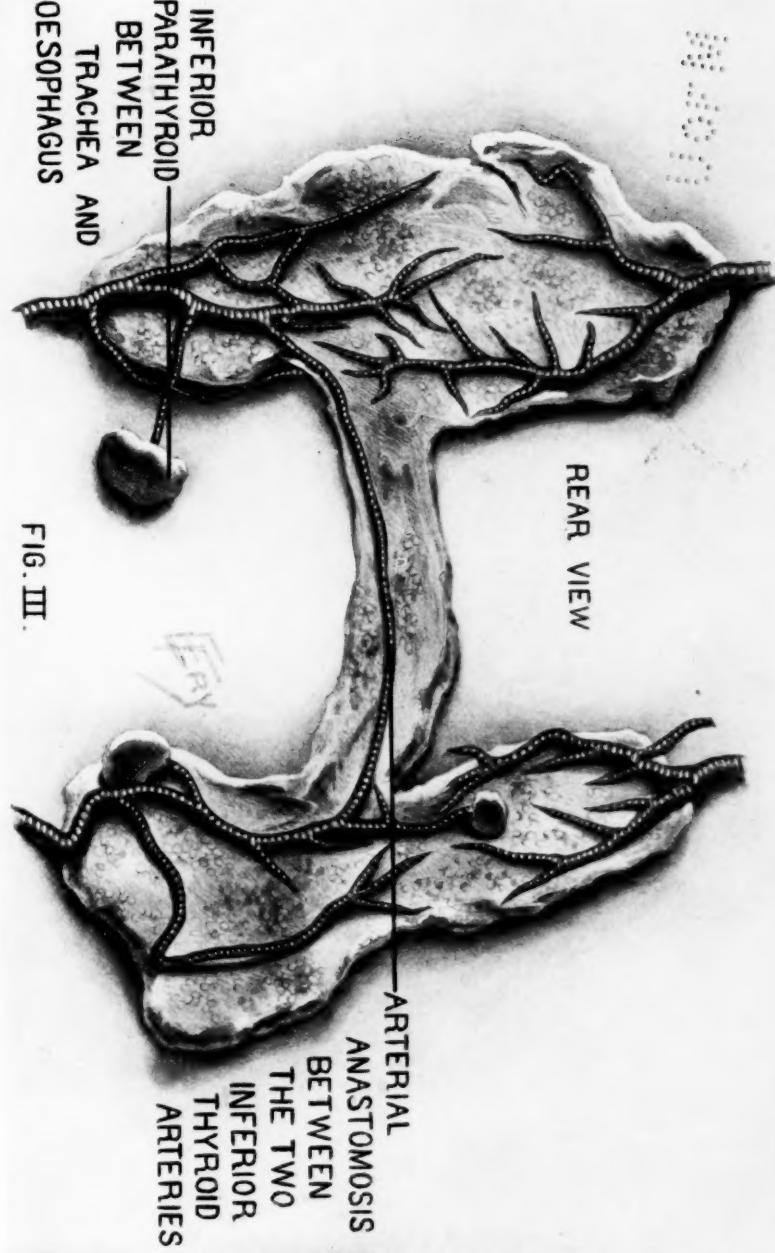
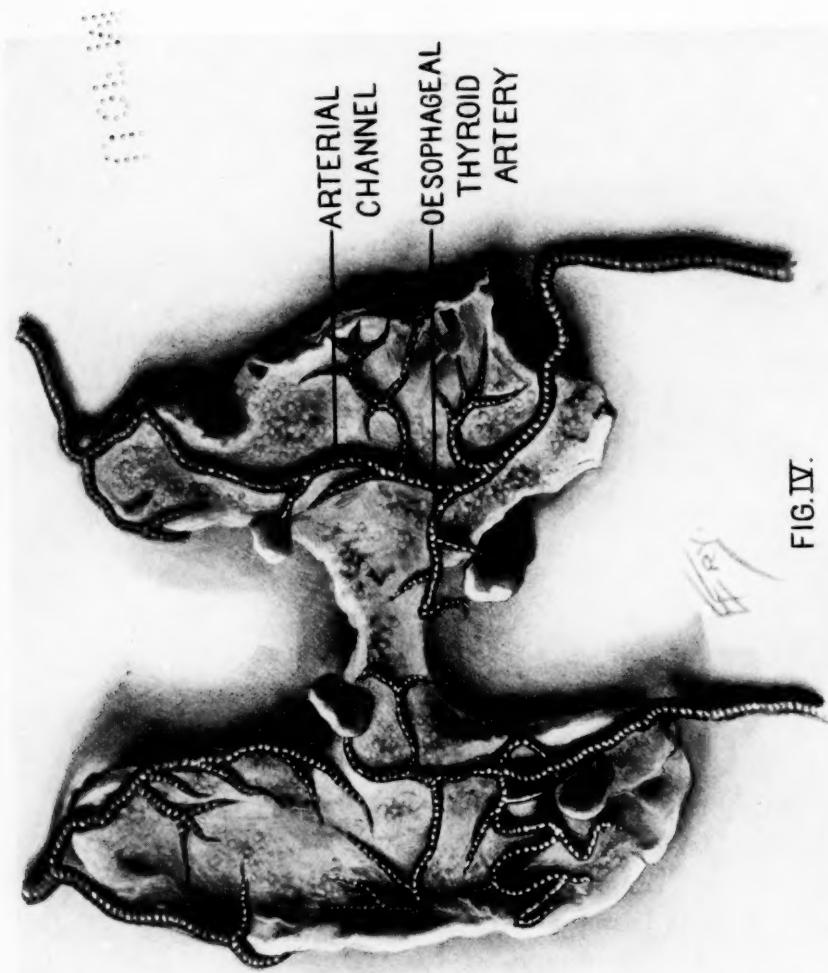


FIG. II.





REAR
VIEW

FIG. IV.

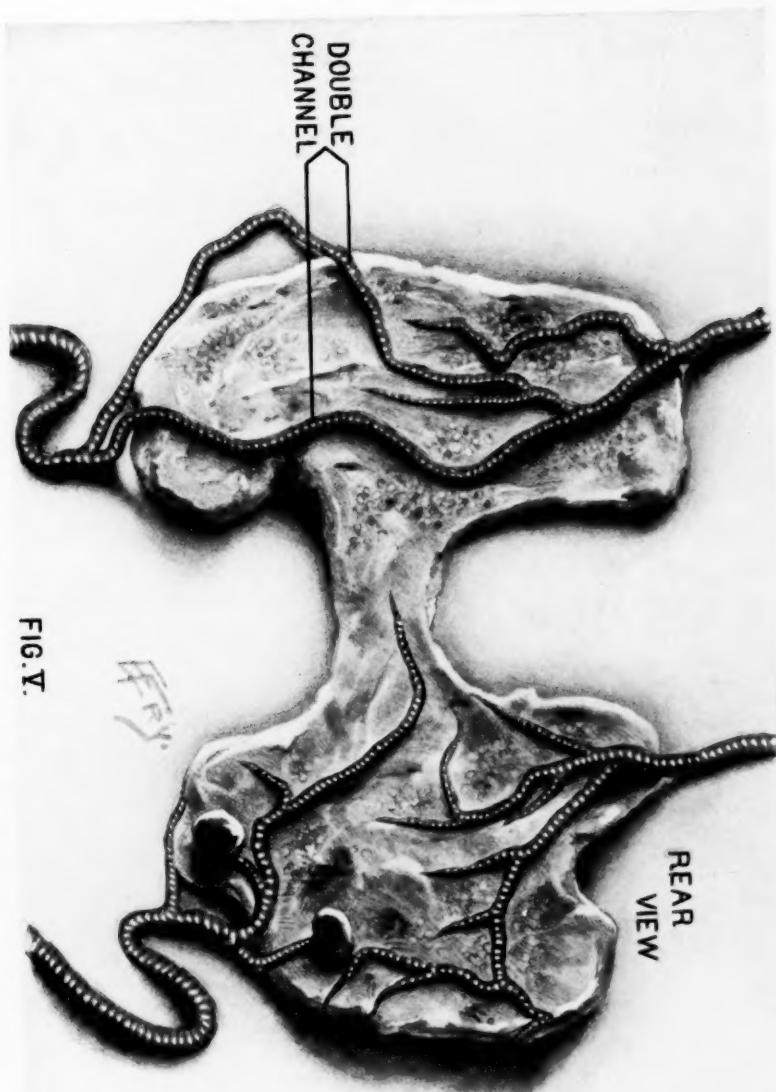
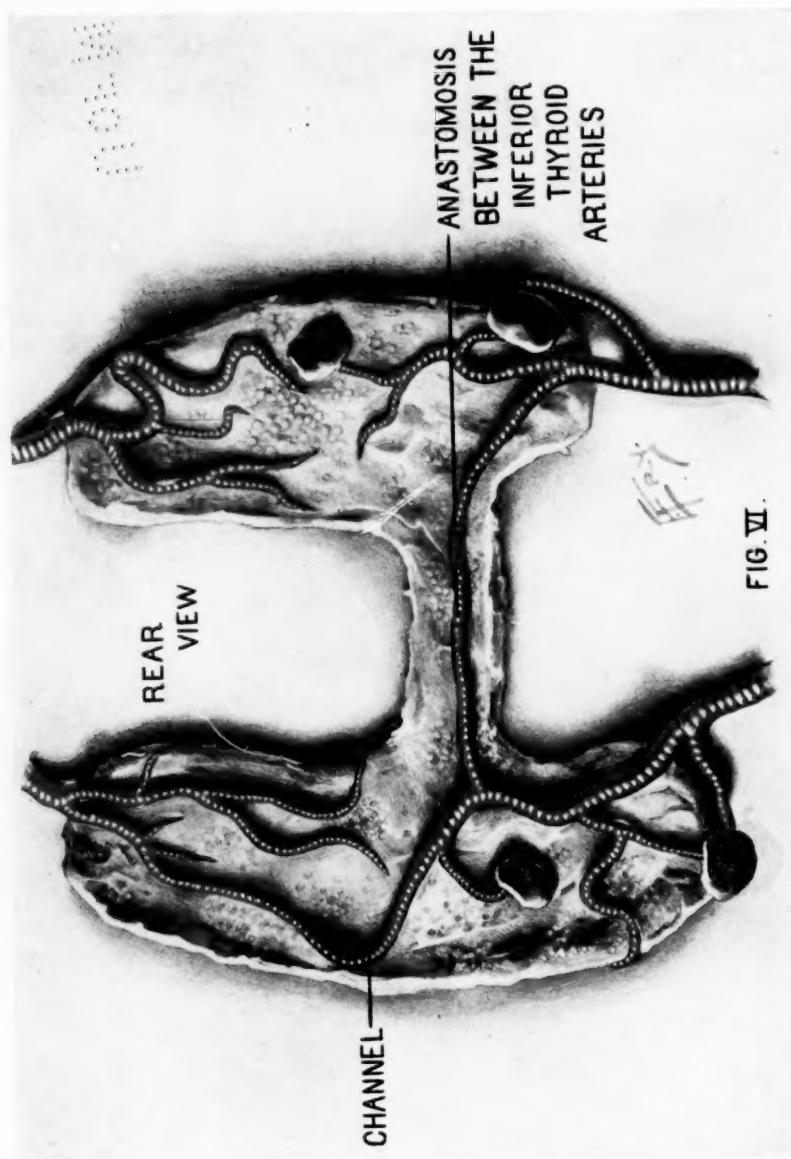


FIG. V.



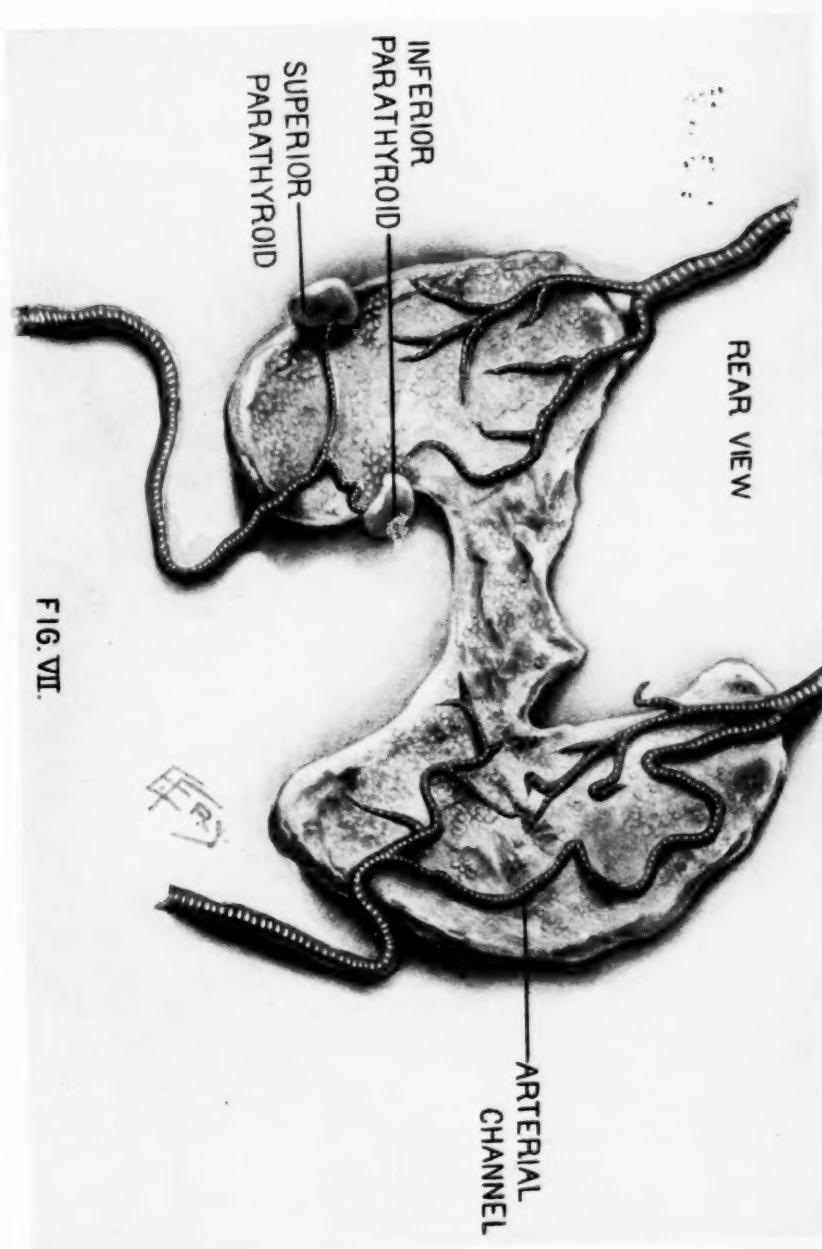
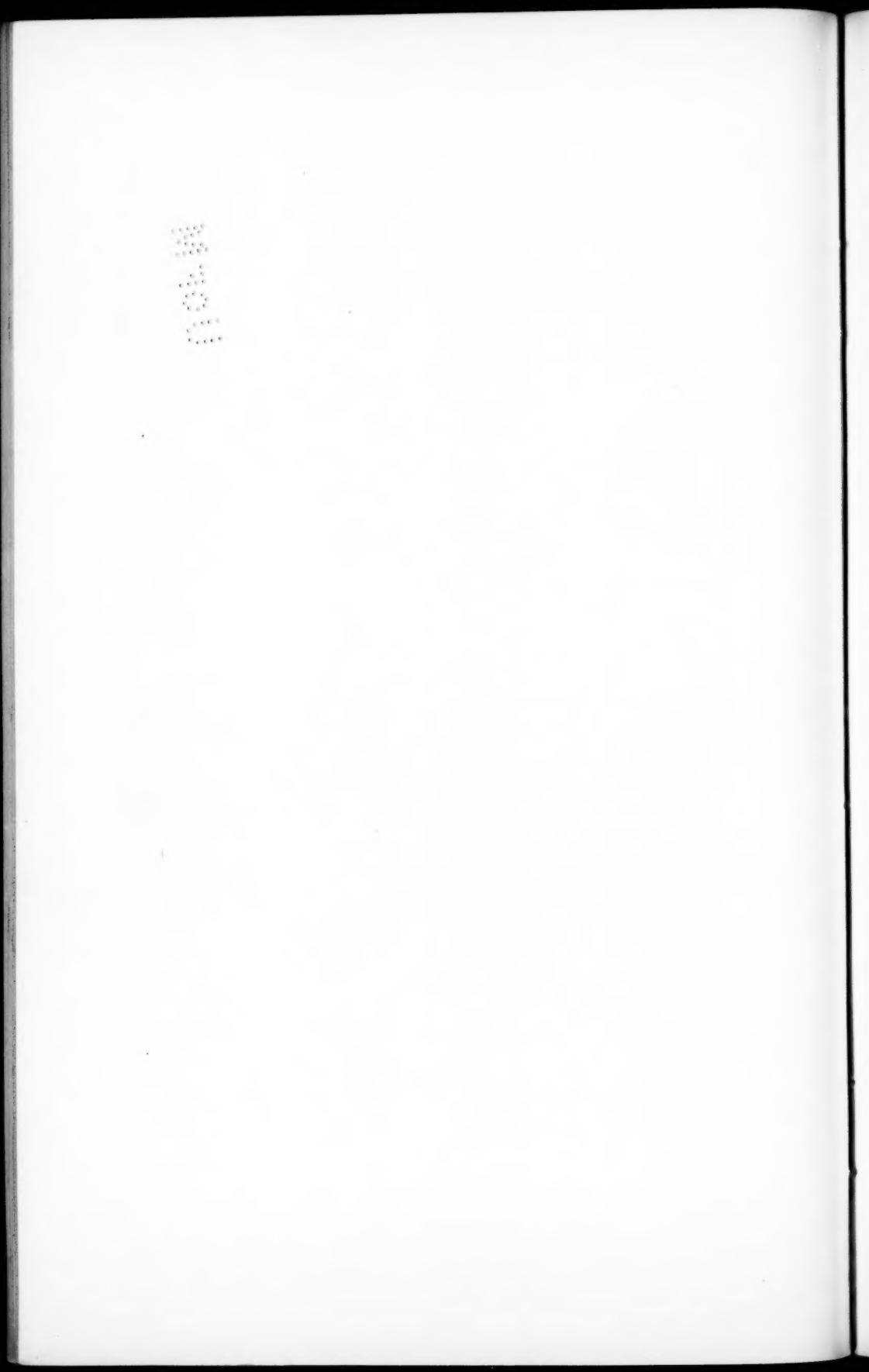


FIG. VII.



thyroid artery. Figs. 2 and 4 offer another explanation why tetany did not result with removal of the whole thyroid. In Fig. 2 the superior gland was not connected with the capsule. It would therefore be left. Its blood-supply would be maintained by the oesophageal connection with the parathyroid artery. Fig. 4 shows the right inferior parathyroid artery a branch of the oesophageal thyroid artery and this gland was only touching the capsule of the thyroid. As all oesophageal arteries anastomose with one another the supply of blood is assured. In Figs. 3 and 6 because of the two inferior thyroid arteries forming an anastomosis with one another across the isthmus of the thyroid, one would be safe in removal of one-half of the gland or the ligation of two arteries on one side. In either case the saving of one gland and its blood is sure.

SUMMARY.

1. The parathyroid glands are essential organs.
2. Each gland has a separate and distinct capsule.
3. The average number to a person is about three.
4. They are generally located on the posterior surface of the capsule of the thyroid.
5. Each parathyroid gland has a special parathyroid artery that supplies it and it alone.
6. Destruction of the parathyroids causes death from tetany.
7. Cutting off of the blood-supply causes the same fatal result.
8. The loss of their blood-supply is the more frequent cause of death.
9. To save them and maintain their blood-supply only the arteries that enter the thyroid gland should be cut.
10. The safest method of operating is from above downward.

ACUTE DILATATION OF THE STOMACH AND ARTERIO-MESENTERIC ILEUS.

BY WALTER B. LAFFER, M.D.

OF CLEVELAND, OHIO.

(Part II. Continued from page 416.)

AN ANALYSIS OF THE 217 REPORTED CASES.

Hoping to throw some light on this subject, or to at least obtain some useful data, I have critically analyzed all the literature and case histories. I have found 217 cases reported in the literature with 135 (63.5 per cent.) deaths; 77 recoveries (36.4 per cent.), and outcome not stated in five cases. Of the 135 fatal cases 120 were examined at autopsy.

Age.—Contrary to the statement Rokitansky made that Acute Dilatation of the Mesenteric Ileus type is more frequent with the aged; we find Acute Dilatation considering all types, as most frequent between the ages of twenty and thirty. Next in frequency, between thirty and forty and then between ten and twenty. Only five occurred before ten years. The oldest was seventy-four.

Beck¹⁸⁹ has written of the cases occurring in children but there were two cases reported in infants worthy of special mention. One reported by Belilios⁵⁰ where a child nine months old always previously healthy and exclusively breast fed. It had no vomiting and no stomach or bowel trouble. The child was found dead two hours after being nursed. Overlying was excluded. Autopsy.—No rickets. Stomach as large as foot ball; no constriction of pylorus. Duodenum not dilated; stomach contained a small amount of milk but a great amount of gas.

The other case occurring in infancy was reported by

Cooper.⁵¹ A child eleven months old, shortly after taking its bottle and while laughing and playing and in good health, suddenly seemed to stop breathing. It "made a noise in the throat," became insensible and died in a few minutes, without a struggle or a convulsion. No signs of rickets or syphilis.

Autopsy showed that stomach was greatly dilated containing nineteen ounces of Mellin's Food, besides a lot of gas, while stomach at this age should hold only about nine ounces. The heart was pale and flabby.

Kundrat⁸³ states that many children suffer from acute dilatation of the stomach due to the filling of the organ with air which is swallowed or with gases of decomposition, and that gluttony in children frequently induces pathologic distension of the stomach which may produce alarming symptoms.

Sex.—Cases were about equally divided between the two sexes. Considering that visceral ptosis has been often blamed for the trouble, and as ptosis is more frequent in women, one would expect the condition to be more frequent with them.

Following an Operation.—Ninety-seven (38.2 per cent.) followed an operation. Of the post-operative cases, as nearly as I can judge, sixty, or 69 per cent., of the cases following an operation, occurred after laparotomies. It was more frequent after operations on the biliary system (occurring 15 times) than after any other operation on a single organ. It occurred next in frequency (11 times) after operation on the kidney; then came the operations on the appendix with five cases. It followed curettage, operation on the uterus, ovariotomy, herniotomy and operations on the stomach, each four times. It occurred eleven times after a variety of operations on the extremities.

MacEvitt¹⁴² says, "The successful completion of an operation, paradoxical as it may appear, is oftentimes but the beginning of a train of sequelæ which place the patient in a more hazardous state and the surgeon in one of perplex-

ity and vacillating inactivity, where skill is thwarted by want of precedent and desire by doubt."

Time of Onset After Operation.—This is difficult to ascertain, as the onset may be ill defined or the post-anesthetic vomiting may mask the onset. It varied from, "immediately after operation" to two weeks after operation. (Robson's case.) It occurred the first day after operation in less than half the cases and onset was most frequent on the third and fourth day.

The Anesthetic.—Of the twenty times where the character of the anesthetic was stated, twelve times it was chloroform and eight times ether.

Following Trauma.—Traumatism was thought to be the cause seventeen times, with onset immediate or after a few days. Only five times was the force applied to abdomen, and in these the epigastrium was most often the part injured. In Edmund's¹⁴⁷ case, patient was shot through dorsal spine, was paraplegic, and acute dilatation of the stomach came on thirty-four days later. Wenner¹²¹ reported a similar case. In other instances the trauma was to thorax, head, spine, extremities, or the location was ill defined.

Occurring During the Progress of a Disease.—Forty cases occurred while the patient was suffering from some more or less serious disease. Pneumonia led the list with six instances; then came appendicitis with four, carcinoma of the oesophagus, three,—abscess of the jaw, three,—localized tuberculosis, two,—miliary tuberculosis, two,—and brain diseases, two.

Spinal Deformity.—With or without the application of a plaster jacket.—In eleven cases, spinal curvature, of various types, was present, (cases of Perry & Shaw, Wichern,¹⁰⁸ Kirsch, Kelling, Kundrat, Schnitzler, Borchardt, Kausch, etc.). In five of these dilatation of the stomach was thought to be induced by the application of a plaster jacket.

Schnitzler and Kundrat both think a pronounced lumbar lordosis favors the occurrence of acute dilatation of the stomach, especially of the gastro-mesenteric type.

Occurring During Convalescence.—Five cases occurred in patients convalescing from typhoid; two followed acute rheumatism, and one, scarlet fever.

Brinton¹²⁷ first called attention to the condition occurring with typhoid. Prof. Damaschino (quoted by Brémont⁴), Albutt (see his *System*), and others have pointed out its occurrence during the convalescence from grave fevers such as typhoid where it may be due to a degeneration of the muscles or nerves of the stomach associated with the widespread muscular and nerve changes so frequently met with in typhoid.

LeGrand (a pupil of Bouchard) in his work, "Dilatation de l'estomac et fievre typhoïde, Paris, 1886," says that people with dilated stomachs are particularly liable to typhoid and claims that typhoid leads to dilatation of the stomach. In one of his cases a previously dilated stomach increased in size during typhoid, while in another a gastric dilatation occurred during convalescence.

Curschmann in his "Der Unterleibstyphus" in Nothnagel's *Handbuch* says he has not seen Acute Dilatation of the Stomach associated with typhoid.

Error in Diet.—Error in diet seemed to be the direct cause in twenty cases (Dilatio ex ingestis). Patient having eaten very indigestible food, or excessive amounts. Grundzach's⁴¹ case, on a wager, ate thirty hard-boiled eggs, drank some wine, and immediately fell over on the floor in collapse. T. L. Brown's case, (cited by Bettman¹⁴⁵) followed eating dried apples. Nauwerk's¹⁴⁵ case had cherry-stones in stomach. Meat poisoning may have been a factor in cases of Friedenwald¹⁰³ and Simon,³⁰ one after eating lobster, and two after sausage, but not in excessive amounts.

Drinking Large Amounts of Fluid or of Charged Drinks. Four times drinking large amount of fluid has been blamed, but here, as thirst is an early symptom, it may be the effect and not the cause of the trouble. Charged drinks, especially a seidlitz powder taken by the patient, as in Rogers'¹²⁰ case; or given by the physician to inflate the stomach may be the

cause of onset, as in the cases of Behrend,⁷² Hoover¹⁷⁸ and Bastedo.¹⁶²

Drugs.—Have been blamed by several. Bäumler⁹⁹ thought sodium salicylate and morphine caused his case. Brémont's⁴ case followed the taking of two grammes of laudanum and Neck²⁵ thought his case was due to veronal.

Emotional Causes.—Andral's⁸⁰ case followed immediately after a severe fright; and excessive laughing Schmorl¹¹⁰ thought was the cause of the onset of his case.

A Chronically Dilated Stomach, that suddenly ceased to maintain muscular tone was blamed in one case.

Health.—This was reported as perfect at the time of onset of trouble in a number of cases.

Previous Stomach Trouble.—This was inquired into in twenty-one instances and was found to have been present (often in light degree) eleven times, and absent ten times. The stomach was carefully examined before the onset of the trouble and found normal in seven cases.

Second Attack.—Leugeu¹⁶⁹ reports a patient that had two attacks months apart, each after an operation on a kidney. His patient responded to the stomach tube treatment. Tuffier⁶⁴ reports a man who had two attacks, each after a slight trauma. My one case had the second attack, or a relapse, a week from onset of first attack.

An Aneurysm.—This was the cause of Ewart and Jeffrey's⁵⁹ case, by pressing on the pylorus.

Tetany.—The complicated cases of Braun¹⁴¹ and Broadbent,¹⁸² and Wright's¹⁸³ case had muscular cramps. Kussmaul⁷⁰ and Fleiner believe that gastric tetany in acute dilatation of the stomach is due to loss of water in the tissues and liken it to convulsive attacks seen in cholera asiatica and cholera nostras.

Traube's Space.—Enlarged and area of liver dulness reduced in a number of cases, and probably these signs are usually present and may be of great value in making a diagnosis.

Complicating Confinement.—Acute dilatation of the

stomach complicated a confinement in two instances. Thomson's⁴⁹ case was due to an ovarian abscess rupturing during delivery, causing a purulent peritonitis and acute dilatation of the stomach. One of my cases occurred less than an hour after delivery. She recovered from the first attack and had a relapse that was fatal a week later.

Peritonitis.—May have been a causative factor in about six cases.

There is no doubt that there are mild often unrecognized cases as well as severe cases of acute dilatation of the stomach, but most of the reported cases are severe ones.

Symptoms and Physical Signs.—The most important symptoms are, vomiting or nausea, abdominal distension, pain, collapse, stomach splashing, constipation, scanty urine, and severe thirst.

Vomiting.—This is one of the most important symptoms and usually the first to attract attention. It is present in about 90 per cent. of the cases. It was stated to be absent in cases of v. Herff¹⁹⁰ and Conner,¹⁸⁸ Edmunds, Dickerson, and Borchardt do not speak of it as occurring in their cases. The most dismal cases are those in which vomiting does not occur, as in these cases the stomach more rapidly distends, and the condition is more easily overlooked. Von Herff's¹⁹⁰ second case belched but never vomited even to the fatal end. He was unable to pass even a stiff stomach tube as it stuck just before entering the stomach, which he thought was due to a kinking at the cardia in consequence of the stomach dilatation as shown to occur by the experiments of Kelling¹⁹⁸ and Braun & Seidel.¹⁴¹ This kinking also explained the absence of vomiting. Vomiting may be present and then disappear for hours or even days, only to return later. It has frequently been absent for quite a period before death. It has been described as "regurgitant," "projectile," "persistent," "incessant," "uncontrollable," "profuse," and "like the pouring of fluid out of a sack" (Bouvert). Henry Morris¹⁸⁰ says, "it comes up in large gulps without straining."

Chanannaz⁶⁴ and Lietaud call attention to the resemblance between the constant regurgitation of mouthfuls of fluid and the incontinence of urine seen with a distended bladder.

The vomitus is usually dark greenish flocculent fluid, but may be black, brown or yellow; and be odorless, foul smelling, fetid or even fecal. It is probable that the black vomiting so often seen in very severe cases of appendicitis and peritonitis is often a symptom of acute dilatation of the stomach as Reynier⁶⁴ believes. The vomitus was fecal in character in the cases of Abbott,²⁴ Balster,¹⁴⁸ Braun,¹⁴¹ Wichern,¹⁰⁶ MacEvitt¹⁴² and Brémont.⁴ A few times it was likened to coffee grounds. The quantity vomited has often been very great and strikingly in excess of the amount of fluid taken, as for instance Miller & Humby¹⁵⁷ reported that their patient vomited "five basinsful" during a single night.

A chemical examination of the vomitus was made in a number of instances and the results were as follows:—Bile is usually present. No HCl was found in nine cases. Hyperchlorhydria was present in two cases. HCl was normal in amount in two cases. Lactic acid was present in seven cases. Yeast cells were found in four cases. Sulphurated hydrogen was noted in one case. Diastatic ferments were found once. One of Wichern's cases showed great numbers of *bacterium coli*, together with staphylococci and streptococci.

Distension.—Distension of the abdomen is usually present, but it was looked for and found absent in five cases. It may affect chiefly the epigastrium or extend down the left side or involve the entire abdomen from ensiform to pubic bones. Tuffier's⁶⁴ case was so distended as to tear out all the stitches and allow the wound to gap, with no covering over the intestines for 15 days.

Collapse.—Collapse, with hypocratic facies, is almost always present and usually occurs early, especially in the severe cases. It is probably referable to a number of things

such as over-stretching of the stomach walls, loss of the body fluids, interference with the breathing and with the heart's action, and innervation disturbances affecting the blood pressure and the vagus control of the heart. A toxæmia may be a factor.

Pain.—Pain, often severe, was stated to be present in 25 cases and noted as absent in four cases.

Thirst.—Thirst may be, as in my case, an agonizing symptom. It was reported present in 12 cases, but probably is usually present.

Pulse.—The pulse at first may be normal. Müller's case did not have at any time a pulse above 76, nor Kundrat's case above 90. The pulse usually becomes rapid early, and when collapse occurs, it assumes the features common to this condition. It had a heart-block-like character in two cases seen by Hoover.¹⁷³ Oppenheim thinks the pressure on the heart, caused by the abdominal distension, the chief cause of the collapse.

Temperature.—Unless influenced by an associated infection, the temperature is usually normal, but is often subnormal.

Abdominal Tenderness.—Was stated to be present in nine cases and stated to be absent in twelve cases.

Constipation.—Was a prominent feature in most cases.

Flatus.—Was passed and this was often helpful in excluding intestinal obstruction, in many cases.

Diarrhœa.—This was a prominent symptom with twelve cases.

Fluctuation.—Of abdomen, was noted several times.

Succussion Splash.—Was obtained in the stomachs of nine patients, probably it is usually present.

Visible Peristalsis.—Over stomach, was stated to be present four times, and stated to be absent twice. It was probably often not looked for.

Thomson² speaks of the absence of visible peristalsis as an argument against obstruction, either at the pylorus or duodenum; but Mayo Robson¹⁸⁴ says, "peristalsis in any

part of the intestinal canal is never seen in acute obstruction, unless it supervenes upon a chronic impediment to the overflow of fluids."

Hypersecretion.—As emphasized by Morris,¹⁸⁰ was noted as a prominent symptom in seven cases.

Hiccough.—Attracted attention enough to be recorded eight times.

Cyanosis.—Was a prominent symptom in two cases.

Dyspnea.—Was severe in eleven instances.

Urine.—Was recorded seven times, as being scanty.

Duration.—This varied greatly from a few hours where cases were mild and treatment early and wise, to cases like Andral's⁸ where the acute dilatation gradually became subacute and chronic. Perhaps four or five days was most often the duration. Many cases ended fatally almost immediately after onset.

Albrecht¹ speaks of chronic cases of Arterio-Mesenterial Duodenal Compression and quotes Glénard and Kundrat as also believing that there occurs cases of incomplete or intermittent closure of the lumen of the intestine. Albrecht cites cases reported by Melbranc⁷⁶ and Weill⁷⁷ as belonging to this type.

Relapse.—Was noted in five instances. In my case it occurred a week after the first attack and caused a fatal termination of the case.

Diagnosis.—The first case seen by any observer has seldom been correctly diagnosed. By once seeing a case or by having the subject in mind, it may usually be recognized. Peritonitis has been the wrong diagnosis most often made. It may be differentiated by the absence of marked tenderness, a normal or subnormal temperature, succussion splash, no leucocytosis, no rigidity of the abdominal muscles, the frequent vomiting of large amounts of the characteristic greenish fluid which often relieves the distension and by passing the stomach tube. The Fowler position would be just the opposite to the one most favorable to recovery from acute gastric dilatation, but otherwise the treatment would

not be very different, as washing out the stomach may help both conditions.

It has been mistaken for a pancreatic cyst and the stomach opened a number of times, but the passing of a stomach tube would quickly differentiate them. Uremia has been the diagnosis often wrongly made due to the vomiting and anuria but should be easily excluded by the stomach tube.

It might be mistaken for gastrosuccorrhea (Reichmann's disease) where we have in the acute variety a sudden onset with epigastric or dorsal pain, gastric tenderness, vertigo, severe retching, vomiting at longer or shorter intervals of large amounts of fluid slightly acid and bile-stained, and great thirst. However, here we do not have distension of the abdomen but rather the belly is sunken, the collapse is less severe and the attacks stop suddenly, leaving the patient with a sense of general well-being. The stomach tube would here again help us.

Intestinal obstruction has often been the wrong diagnosis and it is extremely hard to differentiate an intestinal obstruction high up in the alimentary tract, say in the pyloric, duodenal or upper jejunal region from acute dilatation of the stomach. In both conditions we may have distension of stomach. Vomiting, and collapse following immediately after an operation or after an error of diet would point to acute dilatation of the stomach.

In favor of intestinal obstruction would be a history of the trouble coming on slowly, a long duration, a cachexia, a history of disease of the biliary system or symptoms pointing to a gastric or duodenal ulcer or to a neoplasm. The amount of relief afforded by the stomach tube would throw light on the diagnosis.

Post-operative ileus due to the formation of adhesions is very hard to separate from acute dilatation of the stomach, if the obstruction occurs high up. The passage of the stomach tube will give the best aid.

Other conditions that are similar to, or have been mistaken for acute dilatation of the stomach are volvulus of

the stomach, (Cases of Wiesinger¹⁷⁶ and Streit¹⁹³), pancreatic hemorrhage, a large gallstone acting as an obturator (Wiesinger's¹⁸⁹ Case) in the duodeno-jejunal region, congenital or hypertrophic stenosis of the pylorus (Coate's⁴⁵ case), retroperitoneal hernia, post-anesthetic vomiting, appendicitis (Körte¹⁵⁹), chloroform poisoning (Schnitzler⁸⁵), hematoma of the head of the pancreas, acute hemorrhagic pancreatitis (Gerhardi⁹⁸), hernia through the diaphragm or into the fossae duodeno-jejunalis, spasmodic closure of the pylorus, post-operative hematemesis such as Purves⁴⁷ has described, kidney colic, transient bilious vomiting, perforative peritonitis (Kelling¹⁰⁸), ovarian cyst and gastric crises of tabes.

It would consume too much time to enter into the differential diagnosis of each of the above conditions, but the chief reliance is to be placed on the result after passing the stomach tube, aided by the history and points of difference that will occur to anyone.

Prognosis.—The prognosis is not good, for of the 217 cases reported 135 (63.5 per cent.) have died and but 77 (36.4 per cent.) recovered. The outcome was not stated in five cases. It is probable that the mild cases are frequently overlooked and recover, while the serious or fatal cases are the ones to attract attention and to be reported in the literature. An early recognition of the condition and prompt and correct treatment must improve our statistics.

Treatment—Preventative.—Albrecht advises a careful examination of the stomach for dilatation before all operations or anesthetics. Give no large meals while patient is in bed. Water should be given only by enema at first. Riedel¹²³ would give no fluid by mouth during the first twenty-four hours after an operation. Patients should be made to keep on side or on abdomen as much as possible. Riedel¹⁸⁵ advises in operating in the gastro-duodenal region, to make a large incision so the separation of adhesions and other manipulations can be more intelligently done. And one should keep in mind, as Stieda has pointed out, that the

manipulations in this region are near the solar plexus. Robson,⁷⁴ Cannon¹⁶⁵ and Crile have called attention to the danger of handling the stomach and pulling on the pylorus, as this favors shock and gastro-intestinal paralysis, due to the very abundant nerve supply from sympathetic and pneumogastric. Walzberg¹⁵⁹ thinks the cooling of the viscera at a laparotomy, as well as the handling, sponging and gauze packing, and the chilling and clotting of the lymph in the lymph vessels (which he has observed) all favor the occurrence of acute gastric dilatation.

Müller has mentioned that purgatives before operation, by emptying small intestine, favor its prolapse.

As Borchard¹¹² has suggested one should use great care as to the amount of ingesta taken for the first five or six days. Not too much liquid food, on account of its greater weight. When slight discomfort or belching, nausea or uneasiness occurs, do not delay, but pass the tube into the stomach.

Active Treatment.—Stop all ingesta by mouth. Pass stomach tube immediately no matter how moribund the patient seems. If you are in doubt about diagnosis, use tube, remembering that even in peritonitis it is curative.

Remember that Delbert,¹⁷⁰ and many other observers, think the so-called vicious cycle is really an acute dilatation of the stomach, so use the tube in these cases.

Tube should be passed far into the stomach so as to reach the bottom of the dilated organ, which is often down as far as the pelvis, and thus siphon the entire amount of fluid. Neck¹¹³ and Borchardt have emphasized this point and advise passing tube with patient in the elevated pelvic position, and withdrawing the tube very slowly so as to get all the fluid out. Tube should be passed very frequently.

Postural treatment should be immediately tried, as advocated by Müller,³³ Schnitzler,⁸⁵ Kelling,¹⁰⁸ and Walzberg,¹⁵⁹ who say one should have patient avoid dorsal decubitus position entirely, and have them lie on abdomen, or as long as possible, assume the knee-chest position, with

the weight partly supported by pillows. Lying on the right side with the pelvis elevated, favors drainage through pylorus.

Byron Robinson⁴⁶ found by experiment on the cadaver that pressure of the root of the mesentery on the transverse segment of the duodenum was greatest in the dorsal decubitus position and when the enteronic coils were in the pelvis. He found that the abdominal position relieved the pressure, but not as much as the lateral position.

The abdominal position, which seemed to have saved Schnitzler's⁸⁵ case appeared to make Borchardt's²⁸ patient worse, but in seven cases where it was used, five recovered.

Nothnagel advised us, in order to produce first an anti-peristalsis and later a strong peristaltic action, to use large salt-solution enemata (6 per cent. salt) under pressure of 1½ foot above rectum, with pelvis elevated, and said that after twelve hours effort with clysters, if no fresh gall color is seen in the water expelled, one should try no longer to overcome kinking in this way, but should resort to laparotomy.

Brown and Weill⁷⁷ both bound the abdomen tight, in their cases and with good results, and others have used pads as in treatment of ptosis.

Mayo Robson⁴⁶ advises a gastrojejunostomy in desperate cases and says, "I would suggest that in every case of this kind, no matter at what stage it may be recognized, unless the patient be actually dying, the abdomen should be opened and the stomach emptied and connected with the jejunum, thus providing for continuous drainage into the intestines. I believe that as yet this method has not been put to the test."

Byron Robinson⁴⁶ has reported a cure after this operation and thinks it should always be performed. He also advises severing the duodenum on the right side of the mesentery vessels and securing it to the jejunum anterior to the vessels.

Tschudy¹¹⁸ seemed to have relieved his case by a gas-

tro-enterostomy antecolica, but the patient died of pneumonia later. Rémond's case died after this operation had been performed to effect a cure of an acute dilatation of the stomach.

The operative treatment is falsely based on the belief that most of the cases are due to a compression of the duodenum by the root of the mesentery or on the assumption that a gastro-enterostomy is a drainage operation. A compression of the mesentery was found in only 27 of the 120 cases autopsied, so a gastro-enterostomy would but rarely be indicated to relieve a possible compression of the mesentery. Against the drainage idea we have the experiments of Kelling¹⁶⁶ and Cannon and Blake,¹⁶⁵ which show that a gastro-jejunostomy is of little or no use as a drainage measure. This is borne out by clinical observations made by Mayo,¹⁶⁷ Patterson¹⁹⁴ and others. Tuffier's⁶⁴ case occurred after a gastro-enterostomy and at autopsy both openings of exit were found patulous and yet an acute dilatation of the stomach had occurred. Kelling¹⁶⁸ thinks a gastro-enterostomy is useless for the stomach is too atonic to force the stomach contents through the artificial opening and cites Stieda's¹¹¹ experiment on a dog where, two months after a gastro-enterostomy posterior, he produced by section of both vagi a gastric atony which caused an acute dilatation of the stomach, and at autopsy the stomach was found filled with dark brownish-green fluid and both openings of exit were patulous.

Schnitzler⁸⁵ advises against the suggestion made by some that, the intestines be stitched in place for he fears there might be other obstruction of the intestinal lumen or circulation set up. Kelling¹⁶⁸ advises that the pelvis be tamponed to keep the intestines from entering it, and adhesions will soon hold them up.

Many gastrotomies have been performed, usually because the stomach has been mistaken for a cyst, and all these cases have died. (Watson,³ Brown,¹³⁵, Apple⁷³ and Abbott.²⁴)

Fürstner¹⁸ reports three cases cured by induced electrical currents. Probably very mild cases. He advises us

to also use massage and joins Erdmann⁷ in thinking cold applications to the abdomen are helpful.

Of drugs, Box and Wallace⁶³ advise atropine as used in cases of ileus. Riedel¹⁸⁵ uses morphine. Müller crowds the administration of strychnine to the physiological limit.

Bastedo¹⁶² cured his case by apomorphine injections which emptied into the stomach. Eserin salicylate in doses of $1/40$ gr., hypodermically administered may be cautiously given.

Salt-solution transfusions and enemata should always be used frequently and in large amounts to counteract the great thirst and collapse, and to relieve the fatal fluid starvation of tissue. Its effect seemed magical to Häberlin⁴⁸ in his case where he used transfusion. It may be used to good advantage continuously by enema, as Murphy has advised for peritonitis, and Nothnagel, for mesenteric ileus.

One should give restoratives and stimulants hypodermatically, as a matter of course.

It is important to remember that after the condition is once established it constitutes a vicious cycle, the more the ingesta, or gastric secretion, the greater the pressure of the dilated stomach on the duodenum and against the small intestine, thus increasing the obstruction, etc.

When fluids may be given by the mouth, advantage should be taken of the fact that even weak alcoholic or saline solutions are more readily absorbed and, as Cannon¹⁶⁵ has shown that proteid and fatty food remain longer in the stomach than carbohydrates of the same amount, so the first food should be a finely divided carbohydrate substance.

Death.—As Von Mering showed, no fluid is absorbed from the stomach and but little from duodenum, and as in acute dilatation of the stomach no fluid can reach the small intestine, there must be fluid starvation of tissue. This may, as Kussmaul⁷⁰ and Fleiner believe, be the cause of the tetany seen in some cases. Richardson says the mere deprivation of water, but for a few days, causes death, for if an animal has lost 22 per cent. of its tissue-water, it dies.

Oppenheim of Berlin thinks the mechanical interference with heart and respiration by forcing the diaphragm up is a most important factor in causing death. This view is supported by the numerous cases of death occurring after taking a seidlitz powder for medicine (Roger's¹²⁰ case) or for diagnostic purposes. Hoover¹⁷³ but recently reported cases of tachycardia, bradycardia and heart-block-like symptoms occurring after inflation of the stomach by a seidlitz powder.

Reynier¹⁷⁰ has shown that if you first ligate the cardiac and pyloric openings and then distend the stomach, you cause an extreme fall in the blood pressure and Goltz arrested the heart in diastole, by percussion of intestines.

Perhaps the absorption of toxines from the obstructed loop of the intestine, or from the stomach, is a cause of death; for Clairmont and Ranzi showed that the filtrate of intestinal contents from a loop that is obstructed, is toxic to animals, while in cases where there is no ileus, it is not.

Robson⁷⁴ and others have reported cases of rupture of the stomach and while this is probably rarely a cause, yet it occasionally occurs. Death has occurred almost instantly (Rogers,¹²⁴ Box and Wallace¹⁸³), after a few hours, or a few days, or after a duration lasting as long as thirteen days. (Bräumler's⁹⁹ case.)

Morbid Anatomy.—Stomach is always found dilated and is the most striking feature seen at autopsy. It very often occupies the entire abdomen from costal arch to symphysis. In one case extending even into the true pelvis behind the pelvic arch. It is often "U" shaped or horse-shoe shaped and Fenger spoke of its looking like a very fat arm, flexed, —upper part being cardia and fundus, lower or forearm part being the pyloric end. Kirch likened stomach to a sack hung between pylorus and cardia. Volvulus of cardiac end was present once and of pyloric end once. (Thompson².)

Stomach was vertically placed in four of the cases autopsied. Walls were reported as thin in eight cases; inflamed in one; and thicker than normal, in two cases.

Miller and Humby¹⁵⁷ found the muscular layers of the stomach atrophied and muscles separated so the mucosa was in contact with the serosa.

Albu⁸⁹ found a gastritis parenchymatosa pigmentosa, and mucous membrane swollen, with brownish pigmentation. Bräumler⁹⁰ and Müller⁸⁸ found on the anterior stomach wall greenish spots of superficial necrosis.

Brown,¹⁸⁵ Fagge,¹⁷⁷ and Hoffman⁵⁸ found small hemorrhages into mucosa. Schultz saw a hemorrhagic infarct in his case.

In many cases the microscopical examination of the stomach wall showed nothing abnormal.

Bennett¹⁴¹ found twisting of the cesophagus in his case.

The pylorus was displaced downward in cases of Fränkel,¹³¹ Meyer⁷⁵ and Riedel.³² The pylorus was kinked in three cases.

Riedel's¹⁸⁵ case had a band of omentum passing over pylorus and adherent to lesser omentum. Stomach contents were largely gas in a number of cases, but usually consisted of large quantities of food, as much as two gallons. Adhesions of pylorus to liver, and gall-bladder were reported once.

Duodenum was dilated, to but a short distance and not up to the duodenal jejunal junction, in eight cases. In four cases it is positively stated that there was no dilatation of the duodenum. It was obstructed by a hemorrhage into its walls in one case.

It was dilated up to where the mesentery crossed it, and here compressed by the root of the mesentery, in twenty-seven instances. The small intestine below the duodenum was dilated, *i.e.*, in jejunum and ileum regions in five cases. Duodenum was kinked in its upper part in four instances. There were adhesions about duodenum in one case. Duodenum was compressed by stomach in three cases. (Müller,⁸⁸ Robson,⁷⁴)

Jejunum was obstructed by a large gall-stone in one case. (Hochaus.⁹⁵)

Floating kidney was thought to compress duodenum in Malbranc's ⁷⁶ case.

Small intestines were reported prolapsed into the true pelvis in twenty-one cases.

Therefore, of the twenty-seven cases where the dilatation of duodenum stopped at the point of crossing of the mesentery, the small intestines were reported to be in true pelvis, only in twenty-one cases. It is well to remember, as has been pointed out by several, that it is not unusual for the small intestine to be in the pelvis, where death has occurred from other causes.

Bräumler ⁹⁹ was the only one to find any change in the tissue of the duodenal wall, due to compression of the mesentery. He saw a superficial necrosis of the mucosa at point of pressure. He thinks it was necessary for the stomach weight to be added to the pressure of the mesentery in order to produce this necrosis.

Peritonitis was present in four cases.

Conclusions.—Acute dilatation of the stomach is very fatal, 63.5 per cent. dying. It is not as rare as the literature leads one to believe. This is shown by the rapid increase in the number of cases reported since the subject has become better known.

The pathology and *modus operandi* of acute dilation of the stomach and gastro-mesenteric ileus is not definitely known, but the experimental, clinical, and pathological evidence points to a primary innervation disturbance affecting the gastric nerves or their centers in the brain or cord. It has not been proved that the compression of the duodenum by the root of the mesentery is the primary cause of the so-called arterio-mesenteric ileus.

The diagnosis may usually be readily made by having the subject in mind, especially where we have the presence of distension, vomiting of large amounts of greenish fluid, no rise of temperature, rapid pulse, great thirst, little abdominal tenderness, and increasing collapse. The passage of the stomach tube will usually establish the diagnosis.

Treatment should consist of repeated gastric lavage even when the patient seems moribund. No food or drink should be given by the mouth, but salt-solution transfusions and enemata should be prescribed. Patient should avoid the dorsal decubitus position and assume the knee-chest, abdominal and right lateral positions as much as possible.

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THE REMOVAL OF GALL STONES FROM THE SECOND AND THIRD PORTIONS OF THE COMMON BILE DUCT.*

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THE removal of calculi from the gall-bladder was a recognized surgical procedure, when the removal of stones from the common duct was thought to be beyond the limits of the surgical art.

Surgical invasion of the common duct was at the beginning confined to the supra-duodenal, or first division. Stones in the other portions of the common duct, or in the hepatic ducts, which could not be forced into the first portion were not removed.

With the development of common duct surgery the terminal portions of the duct were invaded, through the duodenum by McBurney¹ and by Kocher;² and by the retroduodenal route, after mobilization of the duodenum, by Haasler³ and others.

The main hepatic ducts were next incised and even their finer ramifications have recently been successfully relieved of calculi (Hepatico-hepaticotomy, 1906, Hawkes⁴).

At the present writing it may be said that concretions have been and may be safely removed from any part of the biliary apparatus.

The common bile duct is a tube approximately 3 inches (7.5 cm.) in length, extending from the junction of the cystic and hepatic ducts, downward, and to the left to unite with the canal of Wirsung and terminates in the wall of the second portion of the duodenum, about 3½ to 4 inches from the pylorus.

* Read before The State Medical Society of Wisconsin, August 22, 1907.

It is divided into three portions: 1st, 2nd, and 3rd. (1) The supra-duodenal extends from its origin to the posterior surface of the duodenum where it comes in contact with the pancreas. This portion is from an inch to an inch and one half in length, approximately half of the length of the entire duct—about 5.8 mm. in diameter. With the hepatic artery, some lymph glands, and the portal vein it lies in the free border of the gastro-hepatic omentum, which forms the anterior boundary of the foramen of Winslow. (2) The retro-duodenal or pancreatic portion is about an inch, or an inch and one quarter in length and lies behind the duodenum, either in a groove on the pancreas or is completely surrounded by pancreas. (3) The interstitial, or transduodenal portion is about one-half to three-quarters of an inch in length and passes obliquely through the inner and posterior wall of the second portion of the duodenum. Its terminal portion is usually dilated, the so-called diverticulum of Vater, into which opens the duct of the pancreas, the duct of Wirsung. This diverticulum may be absent but is present in about nine out of every ten cases. When present its average dimensions are: length 6 to 7 mm., and its diameter 4 to 5 mm. The duct opens upon the duodenal mucosa by a small opening, about 2.5 mm. in diameter, the narrowest part of the common duct.

The orifice is in a papilla; this papilla may often be found by noting a longitudinal fold of the mucous membrane, which is continuous with the papilla and is conspicuous among the transverse valvulae conniventes. It may better be located by the sense of touch, as it feels like a small round shot in the mucosa.

Ascending infection is, in a way, prevented by the oblique insertion through the muscular wall of the duodenum, and the presence of a sphincter muscle, the so-called sphincter of Oddi, which is an augmentation of the circular muscle coats of the duct.

Common duct obstruction is usually due to either malignant disease, or to calculi, which may be either biliary or pancreatic. Congenital stenosis has occurred.

The signs and symptoms are, as a rule, characteristic and consist of repeated attacks of colic, nausea and vomiting, high temperature, constant icterus gradually increasing after each attack, acholic stools. Between attacks, which may occur with marked regularity, most of the symptoms disappear, with the exception of the icterus and a tenderness in the epigastrium. There is a gradual loss of weight and no enlargement of the gall-bladder.

The differentiation between a stone and carcinoma may be made after a review of the history, and observation of the condition of the gall-bladder. Courvoisier's law has been found to hold true in about 80 per cent. of cases, and is as follows: dilated gall-bladder occurs with malignant obstruction of the common duct, while a contracted gall-bladder will be found if the obstruction is due to cholelithiasis. The coincidence of calculi and malignant disease may give rise to confusion. Gall-stones are a most frequent cause of cancer of the gall-bladder, but not so of the gall-ducts. In 22 cases of carcinoma of the papilla, collected by Edes,⁵ gall-stones were found only 4 times, and in 3 of these the stones were in the gall-bladder and only one in the common duct.

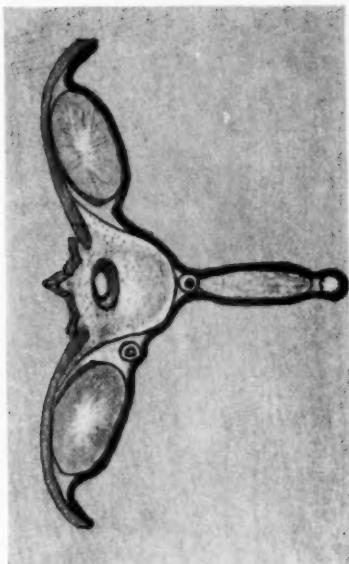
A differential diagnosis between biliary and pancreatic calculus as a rule, is not made, though Moynihan⁶ has made a correct diagnosis of pancreatic calculus. The diagnosis is made chiefly upon the following points:

Colic less severe than biliary colic, diabetes, fatty stools, an absence or late appearance of jaundice, the passage of fragments of pancreatic calculi.

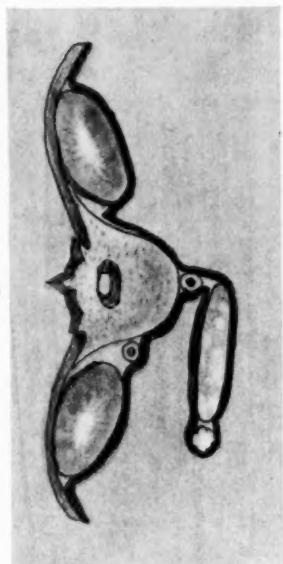
A differential diagnosis as to what particular portion of the common duct is obstructed is neither practical nor essential; a diagnosis of common duct obstruction by stone demands laparotomy and removal of the obstruction providing that the patient is in condition for the operation.

The treatment of stone in the common duct is surgical and consists of removal of the stone. Enlarged lymphatic glands may cause confusion in diagnosis as may disease of the pancreas, or malignant disease of the diverticulum of Vater.

FIG. 1.



A.



B.

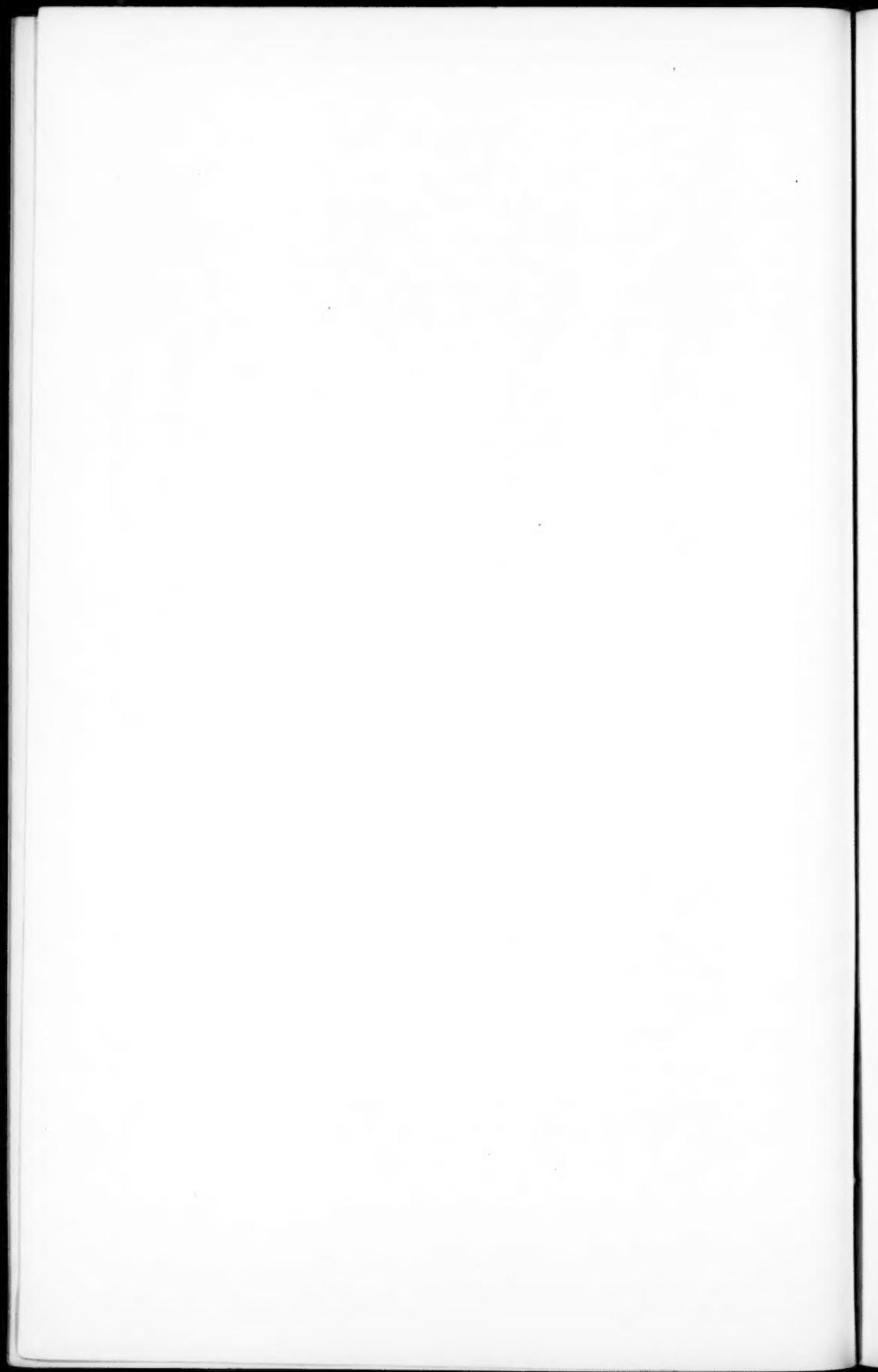


C.



D.

A, B, C, (from Huntington). Diagrammatic representation of three stages in the development of the mesoduodenum, duodenum, and pancreas leading to the secondary "retro-peritoneal" position of these viscera. D. Showing the principle of the "mobilization" of the duodenum, which brings its posterior surface and the common duct into the operative field.



Even W. J. Mayo⁷ mistook a carcinoma of the duct for a stone until it was exposed by incision of the duodenum, and Fenger⁸ did cholecystenterostomy for what was thought to be a carcinoma of the pancreas; only, at autopsy, to find a stone in the ampulla of Vater. Similar errors have been recorded by others.

Concretions in the second and third portions of the common duct frequently escape detection, and they are especially prone to be overlooked in cases in which stones are found in the first portion. Careful palpation of the second portion of the duodenum should always be carried out in all cases of common duct stones. If the lowermost stone removed from common duct is faceted at its distal end another stone should always be looked for.

Kuster,⁹ Fenger,⁹ Terrier,⁹ Lauenstein,¹⁰ Riedel,⁹ Haasler,³ Kocher,¹⁰ Zeller¹¹ and others, report cases in which calculi in the diverticulum of Vater have been overlooked at operation. In the list of reported cases of transduodenal choledochotomy, many have been operated upon previously with the removal of stones from the gall-bladder or common duct. If a calculus is found in the lower portion of the common duct a judicious attempt should be made to force it back into the supra-duodenal portion where it may be removed by simple choledochotomy.

This will usually be possible. In over 2000 operations upon the gall-bladder or ducts the Mayos¹² have had to perform the transduodenal operation for the removal of stone in only 4 instances. In 100 cases recently reported by Kocher and Matte¹⁰ they found it necessary in only 2 cases to approach the duct through the duodenum. Ochsner¹³ in his experience has performed this operation twice and Murphy¹⁴ not at all. This shows the infrequency with which impaction of the stone in the lower common duct occurs.

With a failure to force an impacted stone back into the first portion of the common duct, an effort may be made to pass the stone out of the duct into the duodenum. This is rarely accomplished: Haasler³ reports such an instance and Robson¹⁵ mentions a case in which the stone passed into the

intestine during the manipulations of the operation, and was removed from the bowel by enterotomy. A similar case is mentioned by Pozzi.¹⁶

An impacted stone in the lower portion of the common duct that resists reasonable effort to dislodge it, must be removed by either retro- or trans-duodenal choledochotomy. Attempts to crush or needle the stone are blind and unsatisfactory; lumbar choledochotomy is no longer employed. Cholecystenterostomy or cholecystostomy are merely palliative procedures as they do not remove the stone. Instances may be met with in which the condition of the patient will not allow of any prolonged operative manipulations, and it may then be advisable to establish a provisional or temporary drainage by cholecystostomy, and the obstructing stone may be removed at a subsequent sitting.

RETRO-DUODENAL CHOLEDOCHOTOMY.

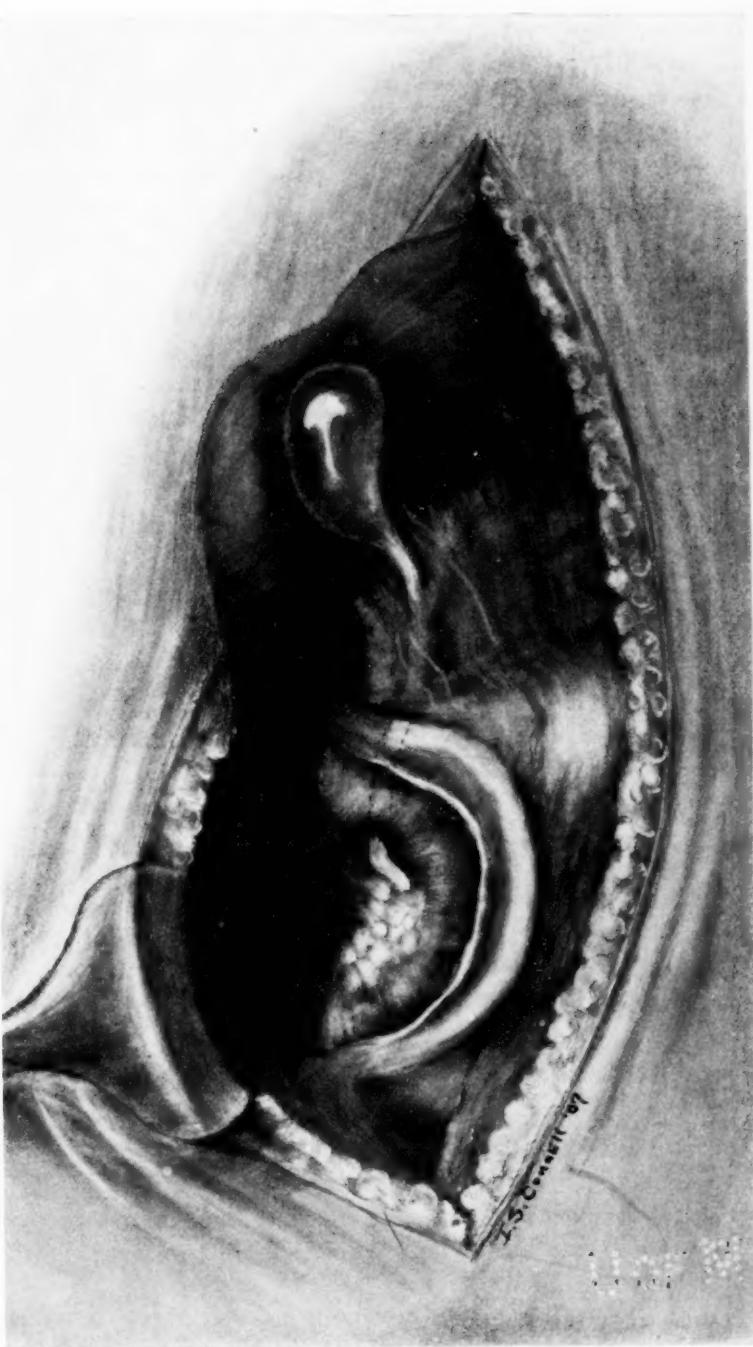
Retro-duodenal choledochotomy consists of an incision into the second portion of the common duct without opening into the duodenum. In order to accomplish this it is necessary to reflect the duodenum toward the median line, to mobilize the second portion of the duodenum as is done in Kocher's¹⁷ gastro-duodenostomy.

This mobilization of the duodenum is a partial reproduction of the condition during embryonal life when the alimentary canal was a straight tube and the duodenum was supplied with a mesentery. The gradual changes from embryonic to mature conditions, with the loss of mesentery, by a blending of the right meso-duodenum and the primitive parietal peritoneum, after rotation of the first part of the small intestine, is well shown in the diagrams of Huntington.¹⁸ (Fig. 1 A, B and C.)

In D, which we have added to Huntington's plate, a common duct has been inserted and the principle of the mobilization of the mature duodenum is shown.

The technique consists of an incision through the posterior parietal peritoneum about an inch to the right of the descending duodenum. The posterior parietal peritoneum and the

FIG. 2.



Exposure of the common duct for retrooduodenal choledochotomy.

1900

duodenum are separated from the retro-peritoneal structures to which they are attached; *i.e.*, areolar tissue. This dissection is best made with fingers covered with gauze. In normal structures no difficulty will be encountered, the bowel will be separated easily and as the blood supply enters mainly at the concavity of the duodenum, the hemorrhage will not be excessive.

After freeing the viscus from the posterior attachments, the rotation is made toward the median line with the hepatico duodenal ligament as a fixed point above, and the left border of the duodenum over the head of the pancreas, as an axis, which brings the posterior surface of the duodenum with the common bile duct and the head of the pancreas into the field of operation (Fig. 2).

Operations in which it is proposed to gain access to the second portion of the common duct by this rotation of the duodenum, have been advocated by Oscar Block,¹⁹ Lane,²⁰ Vautrin,²¹ Haasler,³ Berg,²² and Cooper.²³

In certain cases this operation is quite possible and even practicable, and has been performed successfully many times, but with the coincidence of acute or chronic inflammatory conditions or neoplasms of the head of the pancreas, gall-bladder or ducts, stomach or liver, it may be impracticable or even impossible. Even where these conditions do not exist, the fact that the pancreas completely surrounds the common duct in two out of three cases, necessitating a division of the pancreas, is a point against the employment of this manœuvre.

As Binnie²⁴ well says: "These operations seem better suited to the dissecting, than to the operating room."

TRANS-DUODENAL CHOLEDUCHOTOMY.

The trans-duodenal method consists of an exposure of the common duct by means of an incision through the anterior wall of the duodenum. One of the objections to this mode of approach is, that there is greater danger of peritoneal infection because of the opening of the lumen of the bowel. But with increased experience and with improved technique, the fear of opening into the intestine is rapidly disappearing.

Theoretically there is but little difference, as regards infection, between a direct opening into the lumen of the bowel by a duodenal incision, or an indirect communication with the bowel lumen by means of an incision into the second portion of the common duct, which is directly continuous with the lumen of the gut, and in such a pathological condition that Nature's mechanism to prevent ascending infection is not effectual.

Retro-duodenal incision of the third portion of the common duct, of course, would be practically an opening into the lumen of the duodenum, and the location of the opening is by no means as well suited for proper and secure closure as is the anteriorly placed incision.

A distinction as to whether an impacted stone is in the second or third portion of the common duct cannot always be made.

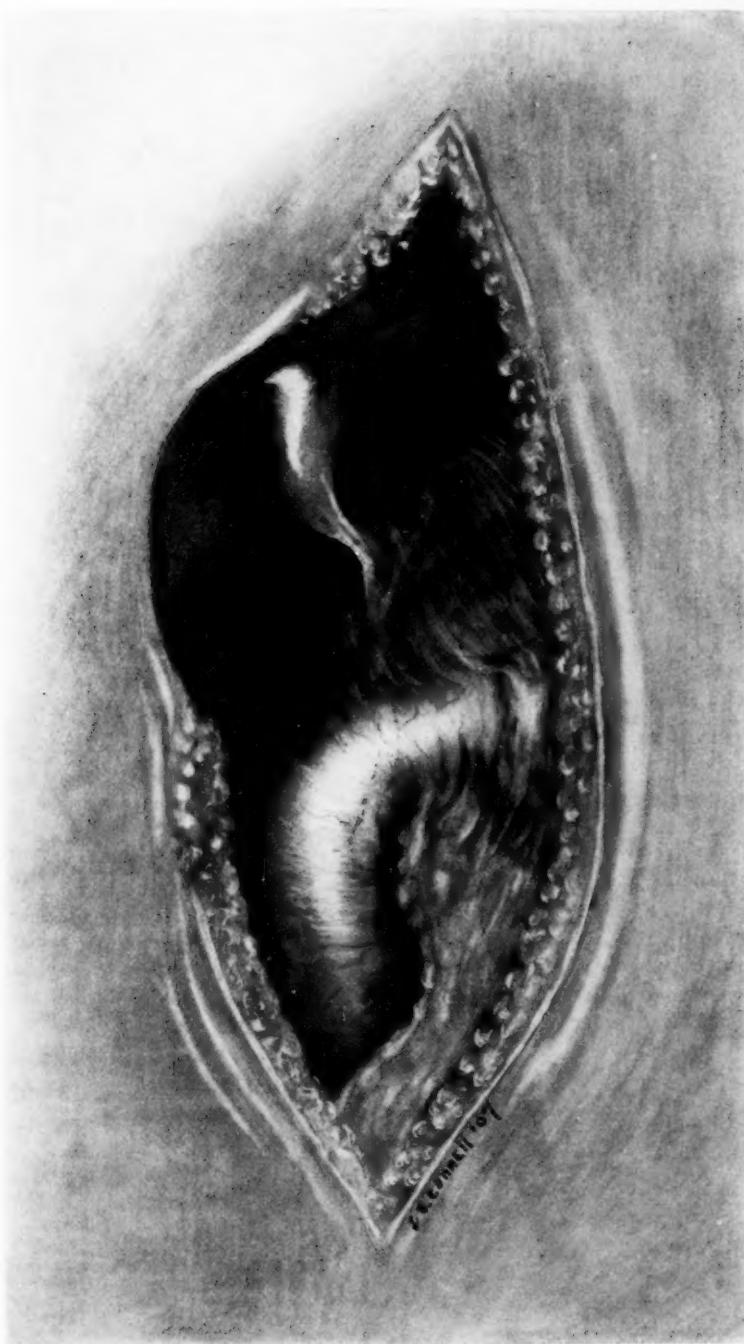
The duodenum is frequently incised for other pathological conditions, and other portions of the gastro-intestinal tract are incised daily without any great fear of infection. But of all portions of the bowel, it would seem from the experiments of Cushing,²⁵ that there is less danger of infections in operating upon the duodenum than on any other portion of the entire intestinal canal, as a preliminary starvation may render this part practically sterile.

Another objection to the trans-duodenal method is that of a possible duodenal fistula with death from inanition, which has been emphasized by Berg,²² who states that such a complication frequently occurs and is due, not to defective suturing as much as to a pathological condition of the duodenal wall, in that adhesions may deprive it of its serous covering.

With secure and proper suturing, followed by rational after-treatment, the occurrence of fistula should be no more frequent in this location than it is after incision in other portions of the bowel. The position of the drainage and its relation to the suture line is all important. The drainage, if used at all, should be placed adjacent to, but not in contact with, the line of suturing.

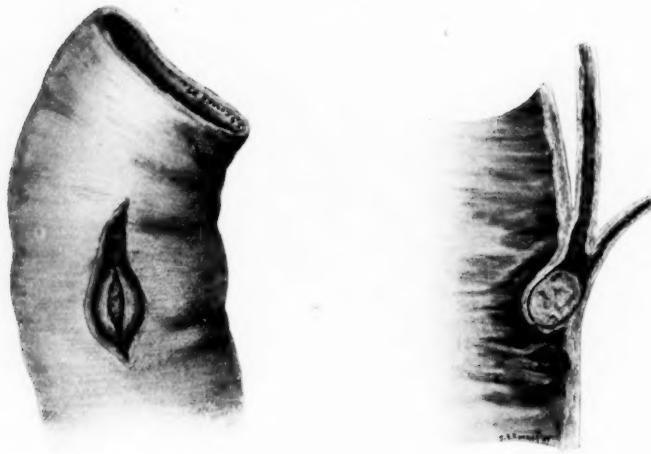
The technique of the operation itself, is as follows: A

FIG. 3



Shows entrance of common duct at the posterior internal portion of the second division of the duodenum.

FIG. 4.



A.

A.—Incision of anterior duodenal wall, and mucosa of posterior duodenal wall, with exposure of stone in the diverticulum of Vater.

B.

B.—Longitudinal section of common duct and duodenum showing stone in diverticulum of Vater.

sand bag is placed under the back at about the level of the liver. The head of the table is raised about 6 inches. The Mayo Robson¹⁵ or the Bevan²⁶ incision is made. A preliminary exploration of the gall-bladder and adjacent structures is made. Gauze packs are inserted in the right kidney pouch and between the stomach and the ducts. Adhesions are separated and the foramen of Winslow opened. Rotation of the liver will be of great aid, if operation upon the first portion of the common duct is necessary. This manœuvre may tear the liver substance but such tears may be easily sutured with catgut and blunt needle.

As a rule it is not convenient to apply clamps to prevent the escape of intestinal contents, and this is generally unnecessary, as after proper preliminary treatment the duodenum will be empty. The stone and overlying structures may be grasped between a finger in the foramen of Winslow and the thumb over the duodenum.

The intestinal incision is made in the second portion of the duodenum parallel to its long axis (Fig. 3).

After exposure of the common duct through the anterior duodenal incision, the stone will usually be seen as an elevation or bulging beneath the mucosa of the posterior wall. The papilla, the opening of the common duct, may be visible below the stone, at the upper extremity of a longitudinal fold in the mucosa, conspicuous among the transverse valvulae conniventes.

The calculus may now be removed in one of three ways according to its size and location. If in the diverticulum of Vater (third portion of the common duct), and is not too large, it may be removed by the method of Collins;²⁷ *i.e.*, dilatation of the opening with forceps, and delivery of the stone through the dilated, but not incised, opening of the duct. If in the same location, but too large to be removed through the termination of the duct, the McBurney¹ operation must be performed.

The papilla may be incised or the mucous membrane between the stone and the lumen of the duodenum, directly over the stone, may be incised sufficiently to remove the calculus (Fig. 4 A and B).

The method of Collins is preferable, but is rarely possible because of the size of the stone, or the pathological condition of the termination of the duct, which will not permit of any considerable dilatation.

Sutton²⁸ says that he has never found a stone larger than a cherry stone in the ampulla. Moynihan²⁹ says stones in this location are usually the size of a split pea. In the case reported with this contribution to the subject the stone was the size of a hickory nut. Robson³⁰ reports a case in which a stone the size of a pigeon's egg was removed from the diverticulum of Vater.

When the stone is impacted in the second portion of the common duct, the transduodenal operation will be that of Kocher.² To remove a stone from this portion of the duct, the entire posterior duodenal wall will be incised, and in addition, the anterior wall of the common duct.

After the removal of the stone it will be necessary to suture the anterior wall of the common duct to the posterior duodenal wall, thus forming an anastomosis between the second portion of the common duct and the duodenum (choledochoduodenostomia interna), in order to direct the bile into the intestine and prevent its escape into the retro-peritoneal space. Undoubtedly, adhesions will often be found between these two surfaces, thus doing away with the necessity of suturing.

The remainder of the operation is similar, in all; and consists of a thorough search for other stones. They may easily escape detection; digital palpation with ungloved finger is to be recommended. Kehr³¹ Mayo³² and others, advocate the performance of a supra-duodenal choledochotomy and the carrying of a sponge through the second and third portions of the duct; in at the supra-duodenal opening and out through the duodenum (choledochusfege, Kehr). In this way one may rest assured that all the stones will be removed. The hepatic and cystic ducts and the gall-bladder are to be explored very carefully.

The incision in the anterior duodenal wall is now closed according to a recognized method of suture, care being taken

to have a secure union. The suture line may be made transverse to the line of incision (duodenoplasty), if stenosis is feared.

The next question is as to drainage: drainage is always indicated. The nature of the operation itself establishes good drainage into the duodenum, but this is not considered as sufficient, therefore, a cholecystostomy is added, or, if the gall-bladder is so contracted as to not be available, as is sometimes the case with common duct stones, then drainage may be established by choledochostomy. Either the one or the other is essential.

SYNOPSIS OF CASE.—*Biliary colic and icterus one year ago. Second attack three months ago, accompanied by symptoms of perforative peritonitis. Recovery: One week after attack, a gall-stone was passed per rectum, since then characteristic symptoms of common duct obstruction.*

Operation.—*Gall-bladder contracted with thickened walls; numerous adhesions, and enlarged lymph glands along the common duct. Mass in posterior walls of second portion of duodenum, evidently in the diverticulum of Vater. Attempts to mobilize the duodenum for the purpose of doing retro-duodenal choledochotomy abandoned because of adhesions and hemorrhage. McBurney's transduodenal choledochotomy performed, with removal of calculus. Exploration of common duct negative.*

Incision in anterior wall of duodenum closed. Cholecystostomy for drainage. Closure of abdomen. Recovery.

History.—Female, age 26 years, housewife, American.

Family History.—Father has gall-stones, otherwise negative.

Previous History.—No illness or accident; has lived out of doors a great deal; is an enthusiastic equestrienne; menstrual history negative. Has been married 7 years and is the mother of 2 children, both labors and puerperia normal. With the exception of an attack of gall-stone colic one year ago, which confined her to bed but a few days, the previous history is negative.

Present Illness.—Begins July 27, 1906, with an attack of hepatic colic, in which she was attended by Dr. Geo. E. Newell of Buena Vista, Colo.

After the administration of morphia, followed by laxatives

and enemata, she was better until the night of July 28th, when she had another severe colic with vomiting, a chill, temperature 104 F., pulse 140 and amaurosis followed by a stuporous condition. Jaundice was present but not marked. I first saw the patient with Dr. Newell at about midnight, six hours after the onset of the attack, when she was in better condition; complained of no pain, temperature 100, pulse 130; there was rigidity of the abdominal muscles of the right side, tympanites and tenderness on pressure over the region of the gall-bladder; she was still in a semi-stupor.

Immediate removal to the hospital was advised, but was not consented to. She remained about the same, with a gradual improvement in her mental condition and amaurosis, until the next night, July 29th, when she had another attack of pain with chill, temperature 105, pulse 150; complained of blindness and again fell into a semi-comatose condition. Tympanites, tenderness and rigidity were marked. Her bowels had moved by the aid of enemata, urine was normal with the exception of the presence of bile. This condition lasted about six hours, and preparations were being made for her removal to the hospital when she suddenly improved, and within 12 hours from the beginning of this attack her pulse and temperature were normal, consequently she did not enter hospital at this time. Gradually improvement followed and a week after the onset of the symptoms she passed, per rectum, a gall-stone about the size of a bean.

She then was up and around, was irregularly jaundiced, but never free from jaundice; had acholic stools at times; nausea and vomiting became constant after meals, with marked gas formation. She had irregular temperature, but no chill. Constant pain and tenderness in epigastrium with loss of weight. Gastric lavage gave slight relief for a time, but as the symptoms persisted and became gradually worse, she finally submitted to operation, for the removal of stone from the common duct.

Operation.—October 1, 1906, D. & R. G. R. Hospital, Salida, Colo. M. E. Connell of Chicago and G. E. Newell of Buena Vista, Colo., present. Ether administered by Dr. Harding; Dr. Johnson assistant. The Mayo Robson incision was made with the patient in the reversed Trendelenberg position.

There were numerous adhesions to gall-bladder, pylorus normal; gauze packs were inserted into the right kidney pouch and to the median line of the common duct. The gall-bladder was

shrunken with thick walls, and of a dark yellowish color; no stones were palpable. The adhesions were broken up and the gall bladder and bile ducts exposed. The finger was inserted into the foramen of Winslow; the gastro-hepatic omentum was thickened and some enlarged and hardened glands were palpated, one of which was removed. The liver was rotated and in doing so the liver substance was torn.

In the second portion of the duodenum a mass about the size of a hickory nut could be palpated. This was located in the posterior wall of the duodenum, evidently a stone in the diverticulum of Vater. The stone could not be forced back into the supra-duodenal portion of the duct, nor on into the duodenum. An attempt to mobilize and rotate the second portion of the duodenum was made, in this way aiming to bring the posterior surface of the duodenum and the common duct into the field of operation; that is, to do a retro-duodenal choledochotomy. An incision was made through the parietal peritoneum about 1 inch to the right of the descending duodenum, but blunt dissection toward the median line was accompanied by so much hemorrhage, and was so difficult, that it was abandoned. Therefore, transduodenal choledochotomy was performed. With the stone and the overlying duodenal wall held between the thumb and forefinger of the left hand, the anterior wall of the duodenum was incised longitudinally in about the midline. This incision opened the lumen of the duodenum and exposed the posterior wall with the stone forming a prominence beneath the mucosa of the posterior wall.

The papillary orifice of the common duct was not distinguished. While the position of the left forefinger and thumb remained the same, a second incision was made directly over the stone through the posterior mucosa, exposing the stone (Fig. 4 A). Forceps were then inserted which grasped and removed the calculus, which was followed at once by the escape of bile. The common duct was explored, but no other stones were detected. The duodenal mucosa was not sutured. The incision in the anterior duodenal wall was securely closed with a single row of through and through sutures of Pagenstecker. The line of union was examined and cleansed with moist sponges. The tear in the liver was repaired with a mattress stitch of catgut. A typical cholecystostomy was next performed and the abdominal wound closed below the drainage tube. Convalescence was uninter-

rupted, and when last heard from, 9 months after operation, the patient was in perfect health.

In a review of the literature we find that Kocher,³⁴ in 1899, was able to collect 20 instances in which the common duct was opened through the duodenum.

In 1902 Thienhaus³³ added 9 to the list; and in January, 1906, Hancock³⁴ was able to collect 60 cases in which calculi were removed from the common duct in this manner.

I have been able to gather, with more or less detail, 77 instances in which this operation was carried out. Cases in which malignant disease was found are not included, nor are simple duodenotomies in which no stone was found in the duct, or in which the stone was found free in the lumen of the bowel. The cases are as follows: McBurney,³⁴ 11; Kocher,¹⁰ 2; Robson,³⁰ 21; Moynihan,³⁵ 8; Kehr,³⁸ 5; Mayo,¹² 4; Sprengel,³⁶ 4; Ochsner,¹³ 2; Ferguson,³³ 2; Robinson,³⁷ 2; Petersen,³⁸ 2; Czerny,³⁸ 1; Langenbuch,³⁸ 1; Terrier,³⁸ 1; Hoffmann,³⁸ 1; Pozzi,¹⁶ 1; Haasler,³ 1; Thienhaus,³³ 1; Dalziel,³⁹ 1; Tinker,⁴⁰ 1; Page,⁴¹ 1; Hancock,³⁴ 1; Lagoutte,⁴² 1; Sherk,⁴³ 1; Connell, 1. Total, 77.

In the 77 cases above cited there were 10 deaths: McBurney 2, 1 due to hemorrhage, 1 due to vomiting; Robson 5, 1 due to acute dilatation of stomach, 1 due to sub-diaphragmatic abscess, 1 due to pyæmia before operation, 1 due to duodenal fistula, 1 due to cause not mentioned; Moynihan 1, due to hemorrhage; Sprengel 1, due to duodenal fistula; Kehr 1, due to cholæmia and hemorrhage. Total, 10.

In all but the two cases in which duodenal fistula occurred the result could not be attributed to the method of the removal of the calculus.

The mortality rate is higher than that following simple supraduodenal choledochotomy, which is between 2 per cent. and 3 per cent. But the transduodenal operation is always a method of necessity and never of election. But it may be necessary during any operation on the gall-bladder or ducts.

In a farther analysis of these cases one finds that 12 cases

occurred in males and 38 in females. As regards the ages: 4 were operated upon at ages between 25-30; 3 between 30-35; 10 between 35-40; 5 between 40-45; 10 between 45-50; 4 between 50-55; 8 between 55-60; 3 between 60-65; 2 between 65-70.

That stones in the common duct, especially its terminal portion, are frequently overlooked during operations upon the gall-bladder or upper parts of the duct is well shown by the fact that in 10 instances, mention is made of a previous operation on the bladder or ducts with or without removal of stones. In 31 cases single stones were removed from the ampulla; in 17 cases two or more stones were removed from the ducts. In 3 instances the calculi were pancreatic.

In 1 case the stone was the size of a pigeon's egg; 1 of a walnut; 1 of a hickory nut; 3 of a grape; 2 of a hazel nut; 4 of a cherry; 3 of a pea. In 7 cases, mention is made of futile attempts to mobilize the duodenum, for the purpose of performing retroduodenal choledochotomy.

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THE REDUCTION EN MASSE OF STRANGULATED AND NON-STRANGULATED HERNIÆ.

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THERE are certain clinical events which are of sufficient rarity to occur perhaps only once or twice in the practice of any one man. No one in consequence has sufficient experience of such occurrences to become an authority, and our knowledge of these subjects is only increased by collecting into a convenient form the opinions and observations of others. This must be done from time to time so as to maintain the knowledge gained from this collective investigation "up-to-date." With regard to the subject of the reduction of herniæ *en masse*, we have set ourselves the task of publishing five or six new cases and of setting forth the accumulated experience of others. But beyond this comparatively unambitious task, we desire to state the classes of case in which we think reduction *en masse* will be found of such common occurrence that every surgeon will see at least half a dozen such cases pass beneath his notice in the course of a year. Thus we would urge that events which are rare in their extreme form, are much more frequent in their lesser degrees; in fact, they may form no negligible part of the material which passes through every surgeon's hands and have been overlooked until revealed by the study of the rarer events which compel attention being given to themselves. Therefore we would urge that there is a practical lesson of frequent applicability suggested in this paper.

Reduction *en masse* has only been recognized hitherto in its acute form, viz.:—the reduction *en masse* of a strangulated hernia. A very considerable knowledge of these acute forms has collected, which we present as follows:—

ACUTE REDUCTION EN MASSE.

Frequency.—During the years 1894–1906 there were 883 cases of strangulated hernia admitted to St. Thomas' Hospital and in the same period three cases of reduction *en masse* occurred, giving the frequency as 1 in every 294 cases. At St. Bartholomew's Hospital, between the years 1890 and 1905, there were admitted 735 examples of strangulated hernia, and two of reduction *en masse*, giving a frequency of 1 in 368. Combining these figures it is found that for 1618 cases of strangulated hernia the frequency of reduction *en masse* is 1 in 331, approximately 3 per cent. In a paper¹ “Gangrene in Strangulated Herniæ” in St. Thomas' Hospital Reports, 1900, it was shown that 14 per cent. of the cases of strangulated hernia admitted to the hospital escaped operation by undergoing reduction; the remainder, 86 per cent., did not undergo reduction. It will therefore be appreciated that reduction *en masse* is a very rare event, because it forms only a minute percentage of the 14 per cent. of the cases admitted as strangulated herniæ in hospital practice.

In all, we examined the records of 137 examples of the reduction of a strangulated hernia *en masse*. The results of which we propose to state briefly in “Registrar Form.” Unfortunately all details are not given in every case, so that the numbers do not add up to 137.

Sex.—Males, 110; 86 per cent. Females, 18; 14 per cent.

Side.—Right, 68; 64 per cent. Left, 39; 36 per cent.

Region.—Inguinal, 113; 83 per cent. Femoral, 22; 16 per cent. Obturator, 2; 1 per cent. Umbilical, 0.

Results.—Inguinal: Recovered, 59; 52 per cent. Died,

¹ Edred M. Corner, Gangrene in Strangulated Herniae, S. Thomas' Hospital Reports, 1900, pp. 341–369.

54; 48 per cent. Femoral: Recovered, 6; 28 per cent. Died, 16; 72 per cent. Obturator: Died, 2; 100 per cent.

It is a curious fact that no example of the reduction *en masse* of an umbilical or ventral hernia should have been recorded, as there is no reason why they should be exempt. The records for the inguinal herniæ differ markedly from those of the femoral variety in having a mortality of 48 per cent., as compared with 72 per cent., bearing out the fact that all through their clinical variations, femoral herniæ have a graver prognosis than do inguinal herniæ.

Method of Reduction En Masse.—By medical man, 50 per cent.; by patient, 28 per cent.; uncertain, 18 per cent.; spontaneously, 4 per cent.

The accident occurs most frequently through the injudicious taxis of the medical man, a grave charge. A further point of interest is that it can occur spontaneously. One of the best examples of this is recorded by Dr. Tonking of Camborne, Cornwall, England, who found the bowel reduced *en masse* from an obturator hernia when performing an abdominal section for intestinal obstruction (*Lancet*, 1904, ii, 917-918).

DURATION OF HERNIA PREVIOUS TO ITS REDUCTION EN MASSE.

On this point it was possible to find a statement in approximately 100 cases, enabling the accompanying table to be made up.

Within	24 hours of its appearance,	8 per cent.
Within	1 year of its appearance,	2 per cent.
Within	1-2 years of its appearance,	2 per cent.
Within	2-3 years of its appearance,	3 per cent.
Within	3-4 years of its appearance,	4 per cent.
Within	4-5 years of its appearance,	3 per cent.
Within	5-10 years of its appearance,	7 per cent.
Within	10-15 years of its appearance,	15 per cent.
Within	15-20 years of its appearance,	7 per cent.
Within	20-30 years of its appearance,	11 per cent.
Over	30 years of its appearance,	18 per cent.
"Years" after its appearance,		20 per cent.

The hernia in which reduction *en masse* occurred of the oldest standing was 62 years; that of the shortest was "a few hours." It would thus seem that the accident of reduction *en masse* occurs most often in herniae of old standing but that it can take place at or shortly after the formation of the hernia. Indeed it is more frequent then than in any year up to the fifteenth or even the thirtieth during which it has been present. These early examples do not necessarily occur in the youngest subjects. For example one man was 48 years of age when he suddenly developed a hernia which was strangulated and reduced *en masse* shortly after its formation.

Age.—The average age for reduction *en masse* to occur was 47. The youngest subject was 13 years of age and the eldest 79.

Between 10-20 years of age, 5 per cent.
Between 20-30 years of age, 7 per cent.
Between 30-40 years of age, 19 per cent.
Between 40-50 years of age, 25 per cent.
Between 50-60 years of age, 20 per cent.
Between 60-70 years of age, 17 per cent.
Between 70-80 years of age, 7 per cent.

Thus it is the older subjects which are the most liable to this accident.

CONTENTS OF HERNIA.

In this series of *acute* cases the viscous which had been reduced *en masse* was almost invariably *small bowel*. In the latter part of the paper we hope to show that the *subacute and chronic* cases will be found amongst the herniae which contain *omentum, large bowel or bladder*.

We now report the four examples of the condition which have been in the St. Thomas' Hospital since 1900. Two recovered, one died, and another which died also illustrates the practical difficulty of dealing successfully with a newly formed sac and a tightly strangulated partial enterocele at an operation.

CASE I.—Strangulated Inguinal Hernia, Reduction en masse

by patient; *Operation, Recovery.* G. C., aged 45, stableman, admitted 22nd January, 1900, under the care of Mr. Betham Robinson. Discharged 4th February, 1900.

Past History.—Ten years ago had a fall which he thinks caused the rupture on the right side as the hernia came down soon afterwards. Sometimes he has had a little trouble in reducing it. He has never worn a truss.

History of Present Illness.—Usually on going to bed hernia went back of its own accord. On 18th January, 1900, patient found hernia "only a little way down," but it caused him considerable pain. He tried to get it back, but does not think he had any effect on it. During night he was very sick, and since this time up to time of admission has had great pain and been sick several times. On night of 18th bowels were freely opened, but had not been opened again up to the time of admission and he had not passed any flatus per rectum from that night up to the time of admission.

On Admission.—Patient was rather collapsed, pulse 80 and weak and respirations 24. Temperature 97.4. Extremities cold. A lump was to be felt in the abdomen in the region of the appendix, but there was very little, if any, distention. Inguinal canal empty.

Operation.—Incision along outer border of R. Rectus. It was found that obstruction was caused by a band of peritoneum constricting a knuckle of gut. This band was wide and firm stretching from the posterior wall of the hernial sac just within its mouth upwards, inwards and backwards to the posterior parietal peritoneum. The sac had apparently been drawn up and inverted. The constricting band was then divided. The sac was cleared of all its attachments, ligatured and cut away. During the operation the patient's condition remained good.

Jan. 23.—Condition much improved; feels quite comfortable and free from pain. Bowels have been twice opened.

Jan. 31.—Stitches removed. Healed by first intention. Since the operation patient has been quite comfortable and feeling very well. Bowels regular.

CASE II.—Strangulated Inguinal Hernia, Reduction en masse of a partial enterocele, Operation, Recovery. C. C., aged 52, pointsman. Admitted 19th November, 1902, under the care of Mr. Betham Robinson. Discharged 6th December, 1902.

History of Present Illness.—Patient has had a rupture for ten years. On Nov. 19th patient was lifting a weight and the rupture slipped down. He attempted but failed to get it back—the pain was very great. Three hours after, a doctor saw him and, after half an hour's taxis, succeeded in reducing the hernia. He vomited three times before admission, bringing up bile colored fluid. Patient vomited three or four times while in hospital before the operation. The bowels have not been opened.

Examination.—There is a lump to be felt deep in the abdominal wall, opposite the internal ring. The rest of the belly is lax and moves well.

Operation.—Incision made parallel to Poupart's ligament on right side over external ring. External oblique divided; on dissecting further down, the sac of the hernia with its contents forced itself up. It had a distinct neck and on opening it up, was found to contain some gut. The constriction was severed, and the bowel slipped back. The bowel on inspection showed an oval area, about the size of two pennies, involving only one aspect of the bowel, which was roughened by inflammatory lymph and of a darker color than the rest. Bassini's operation. Recovery.

CASE III.—Strangulated Inguinal Hernia, Reduction en masse by patient, Operation, Perforation of the bowel, Death. H. M., aged 37, stone carver. Admitted 25th January, 1907, under the care of Dr. Edred M. Corner. Died 31st January, 1907.

Past History.—Patient has had a rupture on both sides for many years. On right side for about ten years and on the left for longer. Patient has worn a truss.

History of Present Illness.—Four days ago the left hernia came down when the truss was on and patient was seized with severe pain in the abdomen, and returning into the scrotum on coughing. The hernia on the right side, which was much the smaller, the patient reduced himself with difficulty on the following day, he was sick two or three times and continued to have pain, and on the fourth day, being again sick and still having abdominal pain he came up to the hospital in the evening.

State.—A thin and weak looking man of 37, looking older than his years and with a very alcoholic history. On the left side a large scrotal hernia, which can easily be reduced, and comes down again on coughing. On the right side there is no hernia

to be felt. Abdomen rather distended and slightly tender on palpation, though not more so in one region than another. Movement on respiration good. Furred tongue; pulse 108; respiration 30; temperature normal. Patient has passed nothing per anum except a small amount of flatus for 4 days. A simple enema was given with good result. The patient was more comfortable, the vomiting ceased, and the pulse rate fell to 96.

Jan. 26.—During the morning, patient became more uncomfortable again and started vomiting. A turpentine enema was given with no result. His pulse rate rose to 112 and he was taken up to the operating theatre at 3 P.M.

Operation.—A laparotomy was performed, and on opening the peritoneal cavity, collapsed small bowel was seen. It was found that a piece of small bowel was strangulated and reduced en masse in the hernial sac on the right side. The neck of the sac was cut and the piece of bowel set free. It was dark in color, and recovered somewhat in tone, the peritoneum was glistening and intact. At the two parts, where the bowel had been constricted, there was a grayish line surrounding the gut, which did not recover much on exposure. The patient's general condition was very bad, and it was impossible to undertake a resection of the damaged part of the intestine or to perform a radical cure for the hernia. The intestine was returned to the abdomen and the laparotomy wound closed.

On recovery from the anesthetic patient was much more comfortable and four hours after the operation had a loose stool. During the next four days patient progressed favorably. He was comfortable, was not sick at all and seemed to be going on well. He had 3 or 4 stools each day, loose in character but becoming more solid, and on the 5th day he passed a formed motion. His pulse varied between 92 and 104, and his temperature remained slightly subnormal. On the fifth day soon after 4 P.M. he began to have abdominal pain. Between then and 8 P.M. he was sick four times and his pulse rose to 112. Before going up to the operating theatre it had risen to 152.

Jan. 31—*Operation.*—It was found that the bowel had perforated at the site of one of the constricting bands. The patient's condition was too bad to undertake a resection, and the perforation was rapidly sewn up and the peritoneal cavity wiped out with dry plugs of gauze, and the abdominal wound closed up.

An intravenous infusion was performed in the ward, but the patient died about 2 hours after the operation.

Post-Mortem Examination.—On opening the abdomen, distended coils of gut were seen. There was a moderate amount of recent peritonitis, and lymph was seen in places glueing the coils together. The pelvis contained dark turbid fluid. The intestines were reddened and a little injected. In the ileum was a small patch of gangrenous, black intestine. It was about one inch in diameter and was attached by stitches on two sides to the gut above and below it. The gut above and below it was covered by a thin coat of lymph, but was not discolored. The small intestine above this patch was distended. Below it, the intestines were small.

CASE IV.—Strangulated Femoral Hernia, Partial Enterocoele, Reduction en masse of the enterocoele at the operation, secondary operation, Death. S. D., aged 39. Female. Married. Admitted December 28th, 1901. Died 2nd January, 1902.

Family History.—Patient's mother had a double rupture. Her sister had a rupture which eventually became strangulated and for which she underwent an operation.

History of Present Illness.—Three days before day of admission patient noticed pain in left groin on coming downstairs and found that a lump had appeared. The hernia was on this occasion reduced by a doctor, but came down again late at night on the day before admission. On the following day the doctor was again sent for but failed to reduce the hernia, and the patient was admitted to St. Thomas' Hospital at night.

State on Admission.—A tense, rather elastic swelling is to be seen and felt in left groin over site of crural canal, about 1 inch in diameter. The swelling is tender on examination, and irreducible, and the patient is suffering a good deal of pain but is not collapsed. Pulse 118.

Operation, 28th December.—Sac of recent origin found, containing small loop of congested small gut, partial enterocoele. Sac was torn in reducing contents. Radical cure by Parry's method. Symptoms of obstruction persisted after operation, although 3 enemata gave good results, and flatus was passed. After operation pulse fell to 82 but began to rise again on 4th night.

Operation, 2nd January. Abdomen opened through rectus

(left) and the previously herniated loop found to be *partially* strangulated by neck of sac: hence the passage of flatus and the good results of 3 enemata. Patient became very collapsed. Intravenous saline infusion given. Death occurred few hours after operation.

Post-Mortem Examination.—Early general peritonitis. Small intestine distended. Point where gut had been strangulated was 24 inches above ileocæcal valve. Below this the bowels were collapsed. Viscera healthy.

EXAMPLES OF THE REDUCTION EN MASSE OF HERNIA WHICH ARE NOT STRANGULATED.

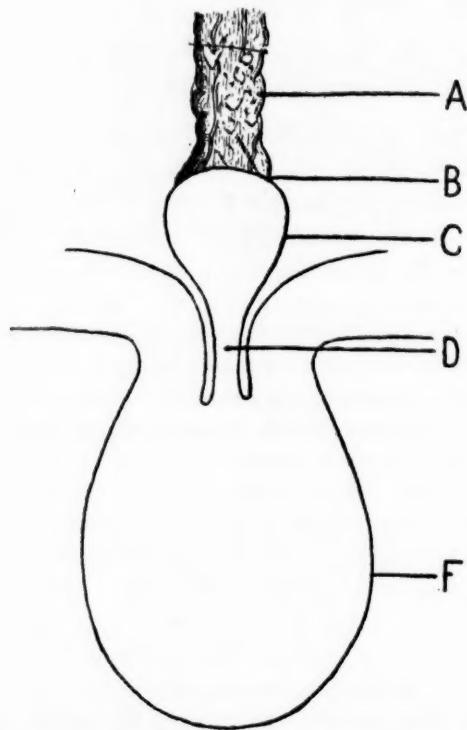
Hitherto it has only been the practice to recognize cases of acute reduction *en masse*, but cases of subacute or chronic reduction *en masse* are plainly recognizable, particularly when the contents of the hernia are other than small bowel. We quote cases to illustrate this.

CASE V.—*Omental Hernia.* Operating upon a young man of 25 years of age in 1905 for a condition diagnosed as a reducible inguinal hernia one of us came across a condition of affairs which gave us the first clue to cases of the subacute or chronic reduction *en masse* of an omental hernia. The hernia "came down" every night and the patient was in the habit of reducing it (*en masse*) and wearing a truss. At the time of the operation the hernia was "reduced." After opening up the inguinal canal, the sac was opened and in it was found a roll of tissue, surrounded with peritoneum, which extended from the fundus of the sac to the abdomen (Fig. 1). On pulling on this cord of tissue a piece of omentum, adherent to its abdominal end, was withdrawn from the abdomen. The mystery was solved; the hernia "was down" (Fig. 2)! It is an obvious inference that the patient was in the habit of reducing this omentum with part of the sac every morning when replacing his hernia, prior to putting on his truss.

We were led to this explanation by finding the curious involution of the sac but the case certainly suggests that similar reduction *en masse* can take place in many instances in which the omentum is adherent to the sac, which suggestion our further observations have confirmed.

Large Bowel Herniæ.—When operating on right sided herniæ it is not infrequent to find that the cæcum has slipped down from the abdomen, behind the peritoneum, so that it has no complete covering of peritoneum. It is then termed a hernia *en glissade*. Yet in some of these instances the patients reduce the hernia and part of the sac with it daily, before put-

FIG. 1.



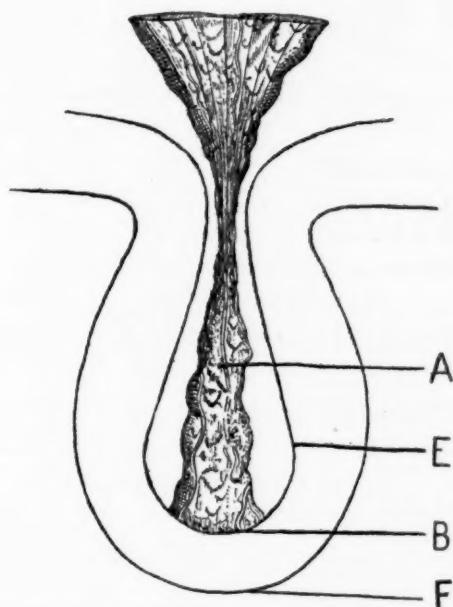
Reduction *en masse* of omental hernia and sac. (A) Omentum; (B) Adhesion between omentum and sac; (C) Inverted and reduced normal sac; (D) The wall inside the part of the sac which remains in the scrotum; (F) It is inverted by the reduction of the omentum (A) and the adhesion (B).

ting on their truss. On the left side a similar condition is found, the lower part of the sigmoid coming down into the hernia when it is incompletely surrounded with peritoneum. In this case also the patients are often in the habit of reducing the hernia *en masse* before putting on the truss. Further than

that, the surgeon when operating removes part of the sac, sews up the rest and reduces the hernia *en masse* before commencing his "radical cure."

Recently we had a good example of this before us. A man came to the "out-patients" at St. Thomas' Hospital with an irreducible inguinal hernia on the left side. He was admitted but allowed to remain in bed as there were no symptoms of strangulation. The hernia became reduced spontaneously.

FIG. 2.



The omental hernia down in the extroverted sac. (A) The omentum; (B) Its adhesion to the fundus of the sac; (E) The hernial sac in the scrotum, uninverted and undisturbed; (F) The scrotum.

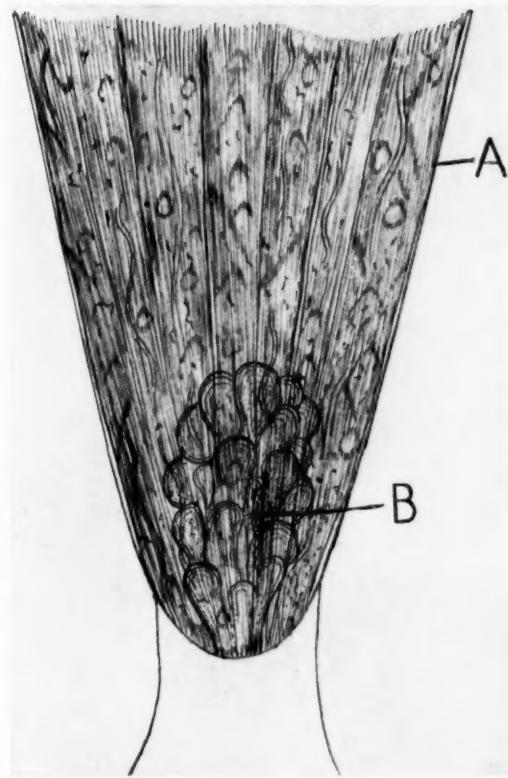
In the out-patients one of us had seen the nontranslucent rupture extending to the bottom of the scrotum. At the operation we only found a sac an inch long! On opening the sac a mass of fat covered with peritoneum and like an appendix epiploica was seen at its neck. By pulling on this mass of fat the large bowel, the colon, was easily brought into view. In this case there can be little doubt that the patient when first

seen, had a hernia *en glissade*, the colon forming part of the wall, extending to the bottom of the scrotum, which became reduced spontaneously. We would also like to urge that the significance of a pad of fat at the neck of the hernia (Fig. 3) is that there is large bowel in the proximity which can, if it has not already, come into the hernia *en glissade*. These pads of fat are not at all infrequently seen during the course of hernia operations and are of some use in putting the surgeon on his guard to avoid the danger of ligaturing part of the large bowel with the sac.

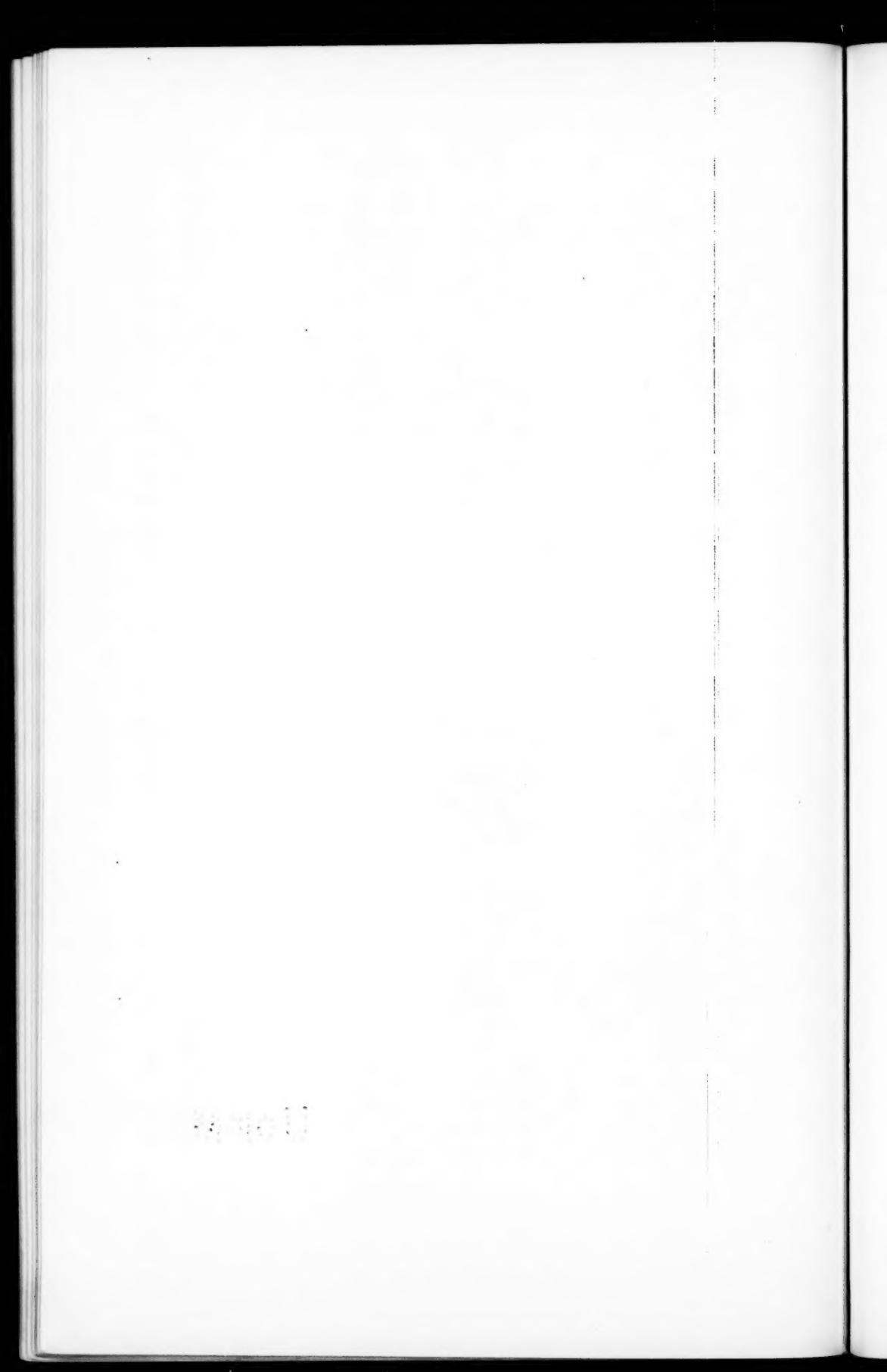
Spontaneous reductions *en masse* are by no means infrequent in children. A number of cases are sent up to the Children's Hospital, Great Ormond Street, as strangulated herniæ; but it is only a small percentage of these which come to operation, the remainder becoming reduced, such as with an ice bag. Considering the frequency with which the cæcum is found in the irreducible herniæ of children, there can be no doubt that some of these cases are examples of the reduction *en masse* of a hernia *en glissade*. Thus there is an intimate connection between all herniæ which arise *en glissade* and the question of their reduction *en masse*.

Bladder Hernia.—There is one further viscus to which we would like to direct attention in connection with the reduction *en masse* of parts of unstrangulated herniæ, namely, the bladder. Every surgeon knows that it is quite common to be able to draw the bladder into the sight during an operation for inguinal hernia by traction on the sac. Again it is not uncommon for the bladder to be at or outside the internal abdominal ring; and in certain cases where there has been a definite bladder hernia, the patient has been in the habit of reducing it (*en masse*) before putting on the truss. As an example of this may be quoted a case recently in the Children's Hospital, Great Ormond Street. A little boy had a right sided hernia, perfectly reducible, which used to be replaced in the abdomen, before putting on his truss. At the operation for the radical cure of the hernia, it was found that the protrusion consisted almost entirely of bladder. Hence it was a case of the habitual reduction *en masse* of a bladder hernia.

FIG. 3.



Pad of fat at neck of sac. (A) The hernial sac which has been slit open; (B) The sub-peritoneal fatty mass at its neck, which indicates the close proximity of the large bowel.



The question may arise as to what distinction we make between the reduction of the contents of an ordinarily reducible hernia and the reduction *en masse* of a subacute or chronic hernia. It is this. In the reduction of the contents of a reducible hernia the contents alone are reduced, the sac remaining outside; whilst in the latter case, both the contents of the sac and the sac are reduced, the sac wholly or partially according to the degree of reduction *en masse* present. The reduction of a hernia *en masse* is most dangerous in acute cases; whilst in subacute or chronic cases it is a beneficial measure; and in some instances of herniæ *en glissade*, it is a recognized method of surgical treatment. In strangulated herniæ it has been recognized for a long time. In non-strangulated herniæ its occurrence has been overlooked and we have urged that illustrations of it will be found most frequently in connection with adherent *omentum*, *large bowel* and *bladder*. In contrast with this the acute forms almost invariably contain *small bowel*.

DIAGNOSIS, PROGNOSIS AND TREATMENT.

The danger of reduction *en masse* lies in its not being recognized and its necessitating a further operation. From the 137 cases examined we know that the surgeon or other medical man was responsible for its occurrence in 50 per cent. of the cases. As it occurs through taxis, its occurrence is a warning against the injudicious use of taxis, particularly in small herniæ of recent formation and large herniæ of old standing. We know from the examination of the recorded experiences of others that it is in these two classes of case that the accident most frequently occurs. Further, we know that the patient's own taxis can cause it; but whilst we can influence the doctor, we cannot control the patient. And yet again we know that it can occur spontaneously and would suggest that an important factor in the production of this is the vigorous peristalsis of the bowel above the obstruction, such as in a case of partial enterocele or Richter's hernia, or in any other case where a small knuckle of gut is strangulated. Thus we would suggest that spontaneous reduction *en masse* is most likely to occur in

cases of strangulated femoral, small and recent inguinal and obturator herniæ. Further, we would like to urge the practical difficulty of making a herniotomy or kelotomy in some cases, such as with a small partial enterocèle, and the possibility of such cases being reduced *en masse* even at the operation. Several such cases have been recorded in the literature, and in this communication we have reported another because it is not generally appreciated that the accident can happen at an operation! And further, we should add that it is only likely to happen after an operation on a femoral hernia.

The diagnosis of reduction *en masse* can be summed up in the words "the continuance of the signs and symptoms of intestinal obstruction after the apparent reduction of the hernia" by taxis or operation. Such a clinical course is only likely to be the result of intestinal obstruction or peritonitis. And it is often impossible to say which. Still, the treatment is easier to decide than the diagnosis. If the signs and symptoms of obstruction persist after the reduction of a hernia, the abdomen should be opened and the reason why ascertained and treated. This should be done with as little delay as is necessary to make the diagnosis of the persistence of the symptoms.

But all cases are not so easy as the above might lead one to imagine. The reduction *en masse* of a partial enterocèle, most likely from a femoral or obturator hernia, may be followed by some relief of the symptoms; the bowels acting and the vomiting ceasing. But in spite of this temporary relief there is no real and lasting improvement. It is sufficient to delay the diagnosis of "unrelieved obstruction" being made before the ensnared bowel is necrosed or beyond recovery, and perhaps the patient may have become too ill to bear and recover from an operation which may be a long one; for it is worse than useless to curtail any steps such as the cleansing of the peritoneal cavity.

An important physical sign in some cases is that the upper part of the inguinal canal on the side of the hernia is indefinitely "full" and not empty.

The proper surgical treatment of these cases is to operate

either by making an incision in the middle line of the abdomen below the umbilicus when the exact diagnosis is uncertain, or if the cause of the illness can be ascertained an incision can be made over the region where the hernia was reduced *en masse*, and especially so if the inguinal canal feels "full." These abdominal incisions can be termed general and local respectively. In the majority of cases the diagnosis is not clear and a general incision is made. A local incision is often adequate for an inguinal hernia but not for a femoral, in which instances the general incision is to be preferred.

If an operation has already been performed and the symptoms of obstruction persist, the general incision is the best.

DIAGNOSIS OF RENAL DISEASE AND SUFFICIENCY.*

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MODERN surgery furnishes no more striking evidence of the keen desire for increased accuracy and advancement in diagnosis and prognosis than that to be found in the laborious and persistent efforts which have been made in order to place before the profession thoroughly trustworthy methods for the estimation of renal disease and sufficiency.

Until recent years, surgeons have been content in their examination of the kidneys of patients to note the mobility, sensibility, and size of the organs, and to rely upon this, together with a more or less careful analysis of the urine, for the diagnosis of renal disease or an estimation of the renal function. Such information as may be based upon these factors alone must be somewhat variable, and in many instances positively unreliable.

It is my object within the limited scope of this article, to direct attention to the value of the routine employment of the cystoscope supplemented when indicated by ureteral catheterization for purposes of diagnosis in the symptomatology of genito-urinary diseases. Naturally, it is not only superfluous but impossible to enter into a detailed description, in a paper of this length, of the asepsis and technique demanded by cystoscopy.

It is extremely interesting to note the progress made by the indefatigable efforts to perfect renal diagnosis. The earliest attempts to catheterize the ureters were made by Axel Iversen,¹ Guyon,² Albaran,³ and Harrison,⁴ resorting to

* Read by invitation before the Philadelphia Academy of Surgery,
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operative procedures of the nature of laparotomy and perineal section. Emmet⁵ and Bozeman⁶ accomplished the same end by colpocystotomy. About the same time it was recommended (Hegar,⁷ Sänger,⁸ Warkalla,⁹ Czerny¹⁰) to place a temporary ligature around one of the ureters from the vaginal route, while in the male sex the diseased kidney was exposed and a renal pelvic fistula established. These practices were soon condemned because too radical and serious, and led to the introduction of the clamp and compression methods of Tuchmann¹¹ and his contemporaries. Noteworthy advances were made by Fenwick¹² and Kelly¹³ in the employment of suction, air distention and direct inspection. Of the segregators or separators the Luys¹⁴ instrument deserves first choice and has proven itself of great value where ureteral catheterization was impossible; unfortunately in the presence of certain vesical conditions, as a medianly located ulcer or area of suppuration, any separator is manifestly useless. Although to Simon¹⁵ and Pawlick¹⁶ is due the honor of priority in catheterizing without intravesical illumination the ureters per urethram in women, it remained for Nitze¹⁷ in the year 1879 to place cystoscopy, in the true sense of the word, upon a practical basis. Since that time, rapid strides have been made in this special method of technical examination, until now in many of the foremost hospitals and urological clinics of the world, it has become a routine procedure. The diagnostic advantages attending the routine use of the cystoscope are so evident, so numerous and so important that further emphasis of the merits of this most important aid in the diagnosis of urinary disorders would seem almost unnecessary.

The cystoscopes commonly employed are the direct vision cystoscope using air distention and the direct and indirect lens cystoscopes, using a transparent fluid medium. Of these methods the first has been almost entirely discarded because of the greater liability to burns, increased pain on account of heat, small size of visual field, inability to measure constantly the amount of inflation, greater danger of infection and limitation of usefulness to the female bladder. In the lens instru-

ments direct and indirect, using always a known definite amount of sterile solution, the degree of distention of the bladder is constant and the anatomical landmarks of the interior are invariable, the visual fields are large, clear, and distinct, there is less pain and burns are unknown. Unfortunately for the direct method the entire bladder cannot be explored, an act readily performed using the indirect illumination. Naturally, any operator will have the greatest success with that form of instrument with which he has had the greatest experience. The extensive use of the indirect lens cystoscope over other forms speaks more than words for the superiority of this instrument.

Many surgeons are inclined to regard the cystoscope as an electrical toy, possessing no distinct advantage. The routine use of this instrument in difficult renal and vesical differential diagnoses cannot be too strongly urged, and indeed in many genito-urinary clinics, cystoscopy is routinely employed. By adopting such a practice, frequently with the simple cystoscope it will be possible not only to make the differential diagnosis between diseases of the bladder and kidneys, but also by noting the conditions and certain abnormalities in and about the ureteral orifices, decide which kidney is diseased, rendering ureteral catheterization unnecessary. Illustrative of this statement, allow me to cite two cases, in the service of Dr. Chas. H. Frazier, to whom I am indebted for the privilege of these reports.

CASE I.—A. L., female, aged 30, was admitted to the University Hospital, May 29, 1907, complaining of a growth in her right abdomen. The social, family and previous medical histories are entirely negative, patient being throughout her life always strong and well. Five months prior to admission she noticed some discomfort when lying on her right side, and consulted a physician who informed her that she had a "tumor." On admission patient felt well, slept well and had a good appetite, but stated that she had lost weight slightly. On the right side in the region of the kidney a large, very freely movable mass was palpable. It was not painful upon pressure and motion, not connected with

FIG. 1.



On the left is seen a ureteral pus cast, protruding into the bladder from the ureteral orifice. On the right the ureteral orifice appears normal, but as on the other side the mucous membrane is generally in a state of marked inflammation.

the liver, and seemed to be located behind and above the colon. Urinalysis demonstrated the presence of a trace of albumen, an occasional hyaline cast, few erythrocytes and a number of leucocytes. The count of the white blood corpuscles numbered 12,300. There was no response to the tuberculin test. Temperature fluctuated between 98° and 100°. Opinion as to diagnosis was divided between a malignant growth and pyonephrosis.

On June 10, I made a cystoscopic examination and observed a cylindrical plug of inspissated pus protruding into the bladder from the ureteral orifice of the right side, rendering the diagnosis of pyonephrosis indisputable. In Fig. 1 are seen colored drawings depicting the cystoscopic findings.

On the same day Dr. George P. Müller, exposed the kidney by Israel's incision, and found it to be about 40 cm. in length and adherent to surrounding structures. These adhesions were so firm and dense that it was impossible to deliver the kidney and nephrotomy followed by the evacuation of much thick pus and drainage was performed.

CASE II.—A. C., female, aged 31, was admitted to the University Hospital, November 6, 1907, complaining of pain in left side of abdomen. Aside from the facts that she had had diphtheria, and one sister had undergone operation for tuberculous cervical lymphadenitis, the previous family and medical histories were negative. Two and one-half weeks prior to her admission patient was awakened during the night by pain in the left side of the abdomen and lumbar region which was persistent, and severe enough to "double her up," on the fourth day radiating down groin to genitalia. This was accompanied by tenderness anteriorly and posteriorly and followed by vomiting, continuing for a week, of a greenish material. No urinary symptoms were present at any time. On admission the complaint was merely a dull ache and tenderness in the left lumbar region. The abdomen was soft, and flabby, and on the left side a palpable slightly tender mass, movable with respiration, extended to within one inch of the median line. The urinalysis was essentially negative, the absence of leucocytes being especially noteworthy. Blood count showed the white blood cells to number only 11,200, and the temperature was never over 98.3-5°.

Three days after admission I made a cystoscopic examination with the expectation of catheterizing the ureters to determine the

functional sufficiency of the supposedly normal kidney, in view of the contemplated nephrectomy of the diseased organ, and found the left ureteral orifice to be very small, atrophic and round, instead of presenting the usual spindle-like appearance. The conditions found are well portrayed by the submitted colored drawings in Fig. 2. It was evident that the left ureter was no longer functioning, and this opinion was confirmed when no urine was collectable after catheterization of the affected ureter. In this case the simple cystoscopic findings demonstrated the uselessness of catheterizing the normal ureter to determine the functional capability of the supposedly normal kidney, inasmuch as it had already proved itself competent to care for the entire urinary excretion.

Five days later Dr. Frazier performed a nephrectomy, at which time merely a shell of kidney tissue was found, the entire kidney having been destroyed and supplanted by a suppurating sac filled with a greenish yellow pus. Laboratory examination of the pus and tissue failed to demonstrate any evidence of tuberculosis.

It is of interest to note also in this case that the cystoscope showed no evidence of cystitis, and with the absence of leucocytes in the urine, confirms the point that extensive pyonephrosis may exist in the total absence of pyuria.

In surgical operations, and especially in those connected with the urinary organs, a failure of the renal function is responsible for a certain proportion of the death-rate. Küm-mell states that whereas he had six deaths from insufficiency of the second kidney in his earlier work, he has had no deaths from this cause since he has employed the modern methods of diagnosis. The consciousness of this fact is a source of anxiety to the surgeon who proposes to operate where known renal disease is present, and this anxiety is accentuated when the operation concerns some part of the urinary tract; it becomes acute when a nephrectomy is to be performed.

To-day, we are in a position, through the efforts largely of Pawlick,¹⁶ Kelly,¹⁸ Brown,¹⁹ and Nitze,¹⁷ especially the last in 1894, by dependence upon the so-called functional renal

FIG. 2.



The picture on the left demonstrates a perfectly normal mucous membrane and ureteral orifice. On the right the ureteral orifice will be observed to be small, round, atrophic and functionless. This was confirmed by catheterization of the affected ureter, when no urine was obtainable.

diagnosis, based upon bilateral catheterization of the ureters, to estimate the comparative function or sufficiency of one or both kidneys. It may be claimed that such men as Casper, Kümmell, Rumpel and Zuckerkandl ²² are enthusiasts in this line of work and over-exaggerate the value to be derived from these difficult and technical procedures. However, the results obtained and to be observed in their clinics dispels any thought of doubt. Time forbids a detailed discussion of the technique and indications for the various methods entering into the determination of the functional capability of the kidneys. Suffice it to say that these, in addition to the usual physical, chemical and microscopical examinations, are *cryoscopy*, the *phloridzin test*, *urea determination*, the *indigo-carmin test*, *methylene blue test*, and the *electrical conductivity of the urine*, of which the last three are least important and generally superfluous. Many are prone to consider, on first thought, functional kidney diagnosis and cryoscopy as synonymous. Nothing, however, could be more erroneous. Cryoscopy, or the determination of the molecular concentration of the blood and urine, is merely one of the several methods of ascertaining the functional sufficiency of the kidneys. Dependence upon the results of cryoscopy alone has led naturally in many cases to grievous errors in diagnosis.

The following is the preparation and routine method of examination employed in the treatment of a given case for the determination of the renal function:

Previous to the examination, the patient is given a definite diet, namely, a breakfast consisting of 5 oz. of milk, a roll and two soft eggs. This restricted ingestion of fluids is given because of the occasional occurrence of nervous polyuria and diuretic influence of phloridzin. A thorough cystoscopic examination precedes and not infrequently renders a catheterization of the ureters unnecessary; sufficient evidence being demonstrable in the bladder to explain the symptomatology.

After thoroughly irrigating the bladder, always under the most aseptic precautions, both ureters are catheterized employing the double-barreled ureteral cystoscope. The first few drops of

urine should not be saved, owing to the fact that the end of the catheter may have taken up pus cells or other matter from the content of the bladder during its passage through the same; or because of trauma and diapedesis at the time of manipulation, a few red cells may have found their way through the eye of the catheter. After one to three c.c. of urine have been collected in tubes, carefully designated *right* and *left* to avoid confusion, these are replaced by two others. If the urine is now dropping from both catheters, desirably *one centigramme* of phloridzin is injected intramuscularly. At the end of 15 to 20 minutes two more tubes are substituted and a few additional c.c. of urine collected. We now have six tubes containing urine. The first pair serve for the microscopic examination; the second pair for the determination of the freezing point and urea; the third pair for the estimation of the artificially produced sugar.

Cryoscopy of the blood, on which formerly so much stress was laid, is falling into disrepute as a valuable diagnostical aid, although Kümmell and Rumpel still attach no little importance to this procedure in urinary surgery. But even they no longer assert a lowering of the freezing point of the blood to -0.60° to be the limit for nephrectomy. Albaran,²⁰ Casper,²¹ Israel,²⁵ Senator²³ and Koranyi²⁴ are all unanimous in the following conclusions:

1. The lowering of the Δ of the blood to -0.60° and beyond may be independent of any renal lesion. Kümmell and Rumpel themselves recognize the possibility of this happening in various circumstances; in lost cardiac compensation, anæmia, diabetes, eclampsia, epileptic attacks and in large intra-abdominal tumors. In all these cases accumulation of carbonic acid in the blood from respiratory insufficiency may determine the lowering of the Δ of the blood.
2. The normal Δ of the blood -0.56° does not indicate that the renal function is insufficient.
3. When the kidney is diseased the Δ of the blood may be -0.60° . Great molecular concentration of the blood has been observed in cases of unilateral hydro- and pyonephrosis, cancer of the kidney and even in renal colic.

4. When the two kidneys are diseased, the Δ of the blood may be normal. A single kidney is sufficient to maintain the normal degree of concentration of the blood, and this work may, perhaps, be performed by the parts of the parenchyma of each kidney that are still intact. Each of those kidneys considered alone would be insufficient.

Albarran²⁰ and others believe that the study of the molecular concentration of the blood is only of practical interest in exceptional cases. When the Δ of the blood is below -0.58° or -0.60° , it may raise a suspicion of a bilateral lesion, but in the greater number of cases, we can arrive at a precise diagnosis by other methods, and notably by analysis of the separate, simultaneously collected urines of the two kidneys. When from any reason it is impossible to study separately the urines of the two kidneys, the investigation of the blood has a real interest. Upon the two repeatedly demonstrated hypotheses that, *normally, both kidneys, at a given time, excrete identical urines, and that sugar is normally equally excreted by both kidneys after "phloridzin" injection, are founded the beliefs of the advocates of modern kidney diagnosis.* This naturally necessitates the synchronous bilateral catheterization of the ureters for the collection of urine over a given period of time. According to Casper²¹ this is the all-important point, and it is only by a comparative study of the simultaneously catheterized specimens of urine that an indisputable judgment can be formed as to the sufficiency or insufficiency of the corresponding kidneys. On the other hand, there are some, including Israel,²⁵ Kapsammer²⁷ and Albarran²⁰ who deny that the composition of the urines of the two healthy kidneys at a given time is identical. Their objection, however, is vastly outweighed by the positive assertions of Casper,²¹ Richter,²⁶ Zuckerkandl,²² Friedrich Strauss,²⁸ Fedorow,²⁹ Bardier,³⁰ Frenkel³¹ and others. Many errors have arisen because of the attachment of too much importance to very small differences. Again, there has been a tendency just as is so often the case in other conditions, medical and surgical, to seek for some sign or test disregarding all the associated diagnostical

aids and procedures, and to make functional renal diagnosis bear the entire brunt of the burden, whereas it is, and only should be, a link in the chain of diagnostic evidence.

In order to illustrate forcibly the great value of modern renal diagnostical methods relative to the estimation of renal sufficiency, allow me to record the following cases:

CASE III.—M. H., female, aged 39, was admitted to Dr. Frazier's service at the University Hospital on October 16, 1906, complaining of dysuria with frequency and urgency of urination and some tenderness in hypogastric and appendiceal regions. Although she has never been of robust development, the family and previous medical histories were negative save that one sister died of tuberculosis, and that for the past eight years there has been occasional frequency of urination and an attack of "malarial fever" of three weeks duration during the previous summer. On admission patient had the above subjective complaints, at times associated with a heavy pulling sensation and some tenderness in the right flank, just beneath the costal margin. Recently, leucorrhœa following urination and loss of weight have occurred. In the right flank, extending about two inches below the costal arch, is a firm, smooth, readily palpable mass, very slightly movable and only moderately tender on manipulation. Temperature did not fluctuate and never rose over 98°. Leucocytic count numbered 4,560. Urinalysis of catheterized specimen demonstrated presence of albumen and a large quantity of pus containing the bacillus tuberculosi.

Two days after admission I catheterized the left ureter using the Kelly instrument to determine the functional condition of the left kidney. During this procedure large quantities of pus were observed to flow from the right ureteral orifice. The urine collected from the right side upon analysis proved to be normal and was productive of no lesions upon inoculations into guinea pigs, conducive therefore to a favorable prognosis following nephrectomy.

Shortly afterward Dr. Frazier performed nephrectomy and ureterectomy of the affected side, and a kidney the seat of advanced tuberculosis both macroscopically and microscopically was removed.

CASE IV.—Male, 34 years; family history negative; in early

life frequently had cervical lymphadenitis; syphilis ten years previously; nephritis two years ago. No pains although almost continuous hematuria; never colic or tenesmus. Patient was very well nourished; no fever; liver palpable; lungs showed no demonstrable lesions; abdomen not tender. In left hypochondrium an indistinct resistance, not tender to palpation was recognizable. Urine: cloudy, bloody, albumen positive, no sugar, sediment demonstrated blood and pus, no casts, no tubercle bacilli. Urination painless but every three to four hours; more frequently by night.

Cystoscopy showed a bullous œdema of mucous membrane about neck of bladder, and in places the mucous membrane was studded with slightly elevated yellowish nodules. Ureteral orifices presented no especial changes.

Functional Examination by Ureteral Catheterisation:—

	Right.	Left.
Appearance	Clear	Cloudy
Amount	13 c.c.	12 c.c.
Sp. g.	1.026	1.010
Δ	1.64	0.43
U	2.0	0.2
Sac.	2.4	0.2
Alb.	0	Moderate
Sed.	—	Pus and red cells

A glance at the comparative determinations of freezing points, urea, sugar, albumen, and characters of sediment, reveals the unmistakable functional sufficiency of the right kidney. Nephrectomy of left kidney demonstrated a *nephrolithiasis* with *pyonephrosis*.

CASE V.—Male, aged 60, in childhood had inflammation of the lungs. About a year ago experienced pain in left side following spring over ditch. Four days later had hematuria of short duration without pain. Sometime later, again hematuria, this time with pain in left side. Recently patient had lost weight (28 lbs.). Never fever, colic, or passage of stones. Abdomen soft. Right kidney palpable. Under left costal arch, distinct ballottement of a tumor extending from mammillary line to umbilicus; movable with respiration, smooth and tender on pressure. Lateral position rendered the findings of palpation more distinct.

Urine: cloudy, sediment contained pus, no casts, but a few R.B.C., small amount of albumen, no sugar.

Cystoscopy revealed a normal bladder, save a slight trabecular hypertrophy and minute blood coagula.

Functional Examination by Ureteral Catheterization:—

	Right.	Left.
Sp. g.	1.020	1.010
Δ	1.29	0.92
U	1.8	1.1
Sac.	0.6	0.05
Sed.	—	Pus; red cells
Alb.	—	Moderate

Here again the importance in the estimation of the functional integrity of the right kidney is manifest. Nephrectomy revealed a *hypernephroma* of the left side and the patient passed through an uninterrupted convalescence.

Although urological surgery has not attained to the full development of its possibilities, and although few noteworthy advances may have been made during the past decade, as claimed by the opponents of functional renal diagnosis, nevertheless concensus of opinion indicates that important strides have been made and still greater ones are destined to occur along the line of functional kidney diagnosis.

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MULTIPLE AND CONSECUTIVE OPERATIONS UPON THE KIDNEYS FOR CALCULI.

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DESPITE the voluminous literature dealing with stone in the kidney, two problems at least have not been exhausted. The first concerns the tolerance of the renal substance of extensive or repeated operative traumas; the second, the frequency with which it is necessary to do consecutive operations upon the kidneys for nephrolithiasis, Watson's¹ recent article indicating that no successful bilateral nephrolithotomy has been reported indicates the lack of literature upon the subject. That the only successful case of bilateral nephrotomy for calculi is the one reported by Watson is scarcely to be credited. It seems more likely that other surgeons have, like myself, operated at the same time upon both kidneys for stone, but have delayed or neglected the report of their cases. Five years ago I did a double nephrotomy for bilateral calculus disease upon one of the patients whose history is appended. About a year later I again operated upon the same patient, doing a bilateral nephrolithotomy. In the following year one kidney was again drained and in 1905 a nephrectomy was done. Finally, in 1906, the remaining kidney was opened and a number of recurrent calculi were removed, this making the third consecutive nephrolithotomy upon the same kidney, and a total of seven operations upon the kidneys in a single case, from all of which the patient recovered. Another patient who recently had a nephrectomy had been subjected to five previous operations upon the kidneys for stone or the resultant suppuration,—a bilateral nephrotomy and nephrostomy having been performed at one time. These and five other cases herewith reported illustrate the feasibility of incising or exploring both

¹ ANNALS OF SURGERY, Sept., 1907.
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kidneys at the same time, of doing consecutive operations upon the same kidney or the not infrequent tendency for calculi to reform after removal.

The tolerance of the kidney to operative procedure is greatly enhanced by the power of regeneration and hyperplasia possessed by the organ. In those cases in which a single kidney is found at birth, the organ is usually twice and at times thrice the average size; only infrequently is the size found to be normal. Likewise, after the removal of a single kidney or its destruction by disease, a compensatory enlargement of the other kidney is usual. Normally, the amount of excreting tissue in the kidney is far in excess of the average need. Life may continue when but half or two-thirds of a single kidney functionates; and it is evident that if life may continue with but a portion of a single kidney active, that the hyperplasia which may gradually follow surgical resections should progressively tend to increase the eliminating capacity for urine, provided destructive inflammatory processes do not occur. From this it would seem that the ability to do consecutive operations upon the kidney involving the removal or destruction of a part of the renal substance should be limited only by the ability of the organ to withstand the immediate trauma, and its power to regenerate after the repeated surgical injuries. The most potent factor in preventing regeneration is infection. Pyelitis and pyelo-nephrosis lead to progressive destructive changes in the renal parenchyma, inhibit tissue regeneration and hypertrophy, and may render consecutive, conservative measures inadequate or inadvisable and a recourse to nephrectomy needful.

Recurrence of Renal Calculi.—Under certain conditions the reformation of stones after nephrolithotomy is to be expected. These conditions include all the factors tending to the formation of stone, which remain after the operation such as:—

(1) *Infection.*—The most important factor in the primary formation of calculi is the presence of bacteria which produce chemical changes in the urine, causing soluble substances in the urine to be precipitated in the form of insoluble compounds. If,

therefore, infection of the renal pelvis persists or develops after the operation, or if there be an ulcerative pyelitis, or incrustation of the mucous lining of the pelvis or calices, then it is very likely that calcareous material will be deposited. At times the new stones escape through the ureter or through a drainage opening; the pyelitis under the better drainage gradually subsides and a cure results.

(2) *Failure to Remove All Stones or Fragments.*—In the removal of large coral calculi it often happens that loose and brittle fragments from the surface of the calculus are left behind in the extraction. As these fragments may escape into dilated calyces or be washed to the dependent portions of the renal pelvis or into the ureter and in any case are prone to be obscured by a deposit of blood clot, it is a frequent occurrence that such particles are left behind. Likewise, in the removal of crumbly calculi which fracture or disintegrate during the extraction, it is often almost impossible to remove every particle of stone. Again where there are numerous calculi pocketed in the different dilated loculi of the calyces one may readily overlook many particles. In cases such as these the fragments of residual stones may wash down the ureter or they may remain and serve as nuclei of other calculi which later demand removal.

(3) *Other foreign bodies*, especially blood clots, bits of suture, filaments of gauze or cotton, unintentionally left in contact with the urinary stream serve as points for the precipitation of salts and the formation of stones. A drainage tube in the kidney or renal pelvis probably also favors calcareous precipitation just as such a foreign body is known to do in the urinary bladder. Nephrostomy and the permanent drainage of a kidney by a catheter theoretically favor the formation of calculi, and in Case II of our series a nephrostomy was followed by the recurrence of many stones within the kidney. Also in Case V calculi apparently reformed under drainage by a nephrostomy.

(4) Finally it cannot be assumed that the factors giving rise to the primary stone have always been eradicated by the

operation or even by careful post-operative antilithic treatment. Therefore, a recurrent calculus may form from the same influences as did the primary one. Fortunately the majority of patients operated upon for stone in the kidney require no secondary operation for retained or recurrent calculi, although following the operation a persistent phosphaturia often associated with slight pyuria may continue for years without serious systemic effect. It is evident that surgical measures should be as thorough and complete as is feasible in the particular case, that no foreign bodies should be left along the course of the urinary stream, and when there is no infection, drainage should either be dispensed with or used for as brief a period as is consistent with the needs of the particular case. In not a few cases an immediate suture of the renal parenchyma and of the over-lying tissues without drainage may safely be carried out and will avoid the danger of secondary infection from the drain tract. While drainage through the loin is often demanded, a permanent nephrostomy opening is undesirable. Two of our cases showed progressive renal infection and tendency for calculus formation despite continuous drainage through the loin. We can endorse Watson's conclusion that nephrostomy is indicated only in certain desperate conditions, especially in malignant tumors of the bladder, and in those patients whose surroundings and mode of life enable the proper care of the apparatus. Repeated nephrolithotomies are preferable in the treatment of recurrent nephrolithiasis to nephrostomy.

The reformation of calculi is to be expected in cases in which the kidney has contained many stones, in those in which there is a well marked pyelitis, a dilated or imperfectly draining renal pelvis or ureter, large fragile calculi imbedded in the renal substance, or renal or ureteral fistulæ.

CASE I.—Calculus anuria and recurrent renal calculi. Bilateral and consecutive operations including four nephrolithotomies, one nephrotomy, one nephrectomy, one drainage operation. Recovery.

Mrs. H. D. M., married, aged 59. Multipara, of spare build, sallow complexion and well marked arterio-sclerosis. The patient for twenty years has suffered from indigestion, violent headaches and sacral backache. There was also dysuria and urinary tenesmus, which were believed to be due to a procidentia with a marked cystocele. Apart from an excess of urates the urine was apparently normal. In March, 1902, she came under my care when a plastic operation was performed upon the cervix and perineum together with a ventral fixation of the uterus. Following this operation the patient developed paroxysms of sharp pain radiating from the bladder toward the groin and left loin. About the fourth of September, 1902, the patient had a sensation of great hunger; she ate heartily and that night very severe, sharp, cutting pains developed in the left lumbar region which radiated toward the bladder. The patient vomited, the abdomen became tympanitic, there was a suppression of urine, and obstipation with retention of flatus. The temperature rose to 103 or 104 and the patient became delirious. Complete anuria persisted about twenty-four hours and by the fourth day the abdominal distention had partially subsided and it was possible to distinguish a large, oval mass of the size of a cocoanut in the left upper abdominal quadrant. In the right loin there was a renal shaped mass two or three times the size of a normal kidney which was not painful or tender. The fever and delirium persisting, on the sixth day of the attack a bilateral nephrotomy and a right nephrolithotomy were performed under ether. On the left side there was a large uronephrosis and a dilated ureteral orifice. No stone was found and while it was believed that there was a stone blocking the ureter the patient's condition forbade prolonged search. The right kidney contained a large fragile coral calculus filling the pelvis and the calyces below the equator of the kidney. The stone was disentangled from the renal substance with some difficulty and removed. Both wounds were drained, the patient progressively improved and during the convalescence passed two fragments of stone. The right sinus closed in about two weeks, the left after several months. In October and November, 1905, the patient complained of pain in the right loin, loss of appetite, insomnia and headache. The urine was slightly albuminous and contained tenacious shreds of muco-pus. A skiagraph by Dr. Pfahler showed the presence of calculi in

both kidneys. The patient's abdominal walls were so thin that the stones in the shrunken left kidney could be palpated between the two hands. A bilateral nephrolithotomy was then performed, four stones being removed from one and three stones from the other kidney. The sinuses soon closed but in 1904 paroxysms of nausea and abdominal tympany with pains in the left loin developed finally a small pyelonephrosis with secondary perinephritic abscess. A simple drainage operation was done under local anesthesia. The left ureter was evidently obliterated and a persistent urinary sinus remained, which was so troublesome that on January 5, 1905, a left nephrectomy was done under the nitrous oxide-ether sequence. In the latter part of 1905, the patient was again troubled with attacks of colic involving the remaining kidney. It was considered inadvisable to administer ether or even make a skiagraph, and on January 1, 1906, under spinal anesthesia by stovaine, the third consecutive nephrolithotomy was performed upon the right kidney and five moderate sized stones were removed. After this operation twelve ounces of bloody urine were secreted during the first twenty-four hours; about twenty-four ounces the second day; and increasing quantities thereafter; whereas after the previous nephrectomy, the first day $46\frac{1}{2}$ ounces were excreted; the second day 34 ounces; the third day 22 ounces and the fourth day 60 ounces. At the present time (December, 1907), nearly two years after the last operation, the patient is active and fairly vigorous; the urine is excreted in excessive quantities, varies in specific gravity from 1.010 to 1.015 and contains a moderate amount of albumin and varying amounts of muco-pus. There is no clinical evidence indicating further reformation of calculi.

CASE II.—Recurrent nephro-lithiasis with secondary pyelonephrosis. Repeated nephrotomies or nephrolithotomies. Bilateral nephrostomy followed by progressive suppuration and recurrence of calculi in one kidney. Nephrectomy and abolition of renal drainage. Recovery.

Miss N. K., age 22, of slight build, and of poor development, had suffered from nocturnal enuresis as a child and always had been troubled by urinary frequency. When sixteen an attack of influenza was followed by aching in both loins with pain radiating to the bladder. The right side was the more painful and was very sensitive to the touch. When eighteen years of age a right

nephrolithotomy was performed; the wound closed in three weeks and the patient remained well about one year. The left loin then became painful, and when twenty years of age the left kidney was opened and forty-six small stones were removed. The incision remained open for two months, was very painful and was complicated by the formation of small recurrent abscesses. Two months later the right side became painful, and when the patient was twenty-one both kidneys were opened by two operators working simultaneously and recurrent stones found in the right kidney. A bilateral nephrostomy was performed. After this operation the patient suffered from difficulty in securing adequate drainage and from recurrent pus collections in the left side. About six months later the left nephrostomy opening was enlarged under local anesthesia, pus evacuated and calculi removed. Later it became difficult to reinsert the tube after its removal for purposes of cleansing, and at times the nephrostomy openings required dilatation. Finally the left catheter could only be introduced when upon a specially curved stylet. The patient first came under my observation October 5, 1907. Catheters had then been worn continuously in both kidneys since May, 1906. The urine from the right kidney is moderately turbid, but from the left kidney is very purulent and offensively ammoniacal. On expression quantities of foul pus exude from the left loin especially after the removal of the drainage catheter. The injection of colored fluids into the renal pelvis proves a free communication from the right kidney to the bladder and complete obstruction below the pelvis of the left kidney. The skiagram shows multiple calculi in the region of the left kidney but none in the right. The patient was admitted to the Samaritan Hospital but despite diet, urinary antiseptics and renal irrigations together with the dilatation of the opening the left nephrostomy failed to drain properly and the suppuration and ammoniacal decomposition in the left kidney continued. On November 5, 1907, under spinal anesthesia by tropa-cocaine, a left nephrectomy together with the removal of the upper part of the ureter was performed. A large cylindrical calculus completely occluded the upper extremity of the left ureter and there were numbers of small stones in the renal pelvis and some of the dilated calyces were packed with concretions. The cortex was thin and the greater part of the kidney was occupied by a series of fetid pus distended

cavities not freely communicating with the renal pelvis. The right nephrostomy opening was dilated and then permitted to close spontaneously. Following the removal of the right nephrostomy tube the opening rapidly contracted and there was very little leakage through the back. Relieved of the suppuration, the constant dread of the nephrostomy tubes slipping, of the discomforts of renal irrigation, and the continuous annoyance of an ammoniacal nephrostomy harness, the patient ten days after the operation showed great mental as well as physical improvement. Later the residual kidney became painful, fever developed and the nephrostomy drainage had to be renewed temporarily.

CASE III.—Right nephrolithiasis mistaken for appendicitis. Appendectomy. Nephrolithotomy and removal of over twenty calculi. Recurrent colic, secondary nephrotomy. Recovery.

Mr. S. K., age 59. Manufacturer. Plethoric. For many years has had paroxysms of pain in the region of McBurney's point. He alternates between diarrhoea and constipation, sleeps well, has a good appetite, some indigestion, and is morose and irritable. Seven years ago the pain and tenderness were so great that an appendectomy was done but the frequent attacks of colic in the right side continued and a secondary operation was considered for adhesions which it was believed had formed about the colon. I first saw the patient in 1903, when it was said he had been rejected for life insurance because of albuminuria. On examination no albumin was found in the urine but later the patient was seen at his house in a violent paroxysm of pain following which a few erythrocytes were found in the urine. There was a distinctly tender, rather indefinite mass in the region of the right kidney, and the jar of walking or of car riding produced pain in the right loin. There had been no typical ureteral colic. In May, 1903, under ether anesthesia, over twenty stones or calcareous fragments were removed from the right kidney. These occupied in part the pelvis and a part of the dilated calyces, the different cavities having such small communicating openings that four separate incisions through the cortex were necessary for their removal. Gauze drainage was used to the kidney, the patient soon improved. Later there was a return of pain in the kidney which was relieved by a secondary nephrotomy about three months after the first operation. The mental depression

then disappeared and the patient continued well over four years from the time of the second operation.

CASE IV.—Calculus in the right renal pelvis mistaken for appendicitis. Appendectomy. Removal of the calculus through an incision in the renal pelvis with suture, drainage. Secondary pyelonephrosis and urinary fistula with recurrent calculi. Nephrectomy. Recovery.

Mr. X. Single, age 24. Physical condition and development good. The patient had suffered from recurrent attacks of pain in the neighborhood of McBurney's point for which an appendectomy was done about two years ago. The operation failed to relieve the patient of the attacks of colic which continued in the region of the appendix with some tenderness in the right loin. The urine contained a small quantity of pus and blood. The kidney was exposed and a calculus about one centimeter in diameter found in the renal pelvis. The stone was removed by an incision through the pelvis of the kidney which was sutured and a small gauze drain introduced through the wound to the line of suture. The patient left the hospital apparently improved but a urinary sinus formed in the region drained and later the patient developed signs of pyelonephrosis. About four months after the second operation the patient first came under my care, and under scopolamin-morphin anesthesia the suppurating kidney was removed. There had been no recurrence of calculi in the renal pelvis. The patient made a good recovery. This case well illustrates the danger of urinary fistula and renal infection after the removal of calculi through the pelvis of the kidney. The danger is much increased if the gauze or drainage tube be left against the line of suture. Had the stone been primarily removed by incision through the renal cortex the necessity for a secondary nephrectomy would have been less likely.

CASE V.—Nephrolithiasis, uronephrosis, ureoureter; nephrolithotomy, nephrostomy. Imperfect drainage of distended ureter. Development of pyelonephrosis. Secondary nephrectomy and ureterectomy. Death.

Mr. W. C., aged 25. American, clerk. Fairly well developed but not robust, was admitted to the Samaritan Hospital September 21, 1905. For more than a year he had suffered from recurrent attacks of colicky pains in the lower left abdominal quadrant, which began and ended rather abruptly and were associated with

formation of a globular mass palpable about the left sacral brim. These attacks interfered with the patient's work, and were gradually undermining his health. Diagnosis of intermittent uronephrosis and ureoureter was made and under scopolamin-morphin narcosis the left kidney was opened September 26, 1905. The pelvis was dilated and through the pelvis the finger could be passed into a greatly dilated ureter. An attempt to pass a sound from the kidney into the bladder failed, the instrument being arrested just below the pelvic brim. A number of small calculi were removed and as the patient's condition on the operating table became critical the ureter was drained by a tube passed through the wound in the kidney and the patient returned to bed. The greatly enlarged ureter failed to drain properly so that despite irrigation and a tube passed through the nephrostomy opening there was a constant tendency for residual urine to remain in the ureter. The temperature was irregular varying from normal to $102\frac{1}{2}$, and as a rule the pulse ranged from 90 to 110. From time to time small calculi were washed from the kidney or ureter. As the patient became progressively weaker, a second operation was attempted October 26th. The man was again anesthetized by scopolamin-morphin, the kidney was exposed, and adjacent to the wound tract many miliary abscesses were found. A second incision was made above and nearly parallel to Poupart's ligament on the left side, the peritoneum pushed forward until the thick wall of the ureter, which had a diameter of 3 or 4 cm., could be exposed, isolated and divided low down. The kidney and upper end of the ureter were then freed through the incision in the loin and the kidney with the attached ureter removed. The wound was packed with gauze and the patient, very weak, was hurried to bed. Several hours later there was some oozing from the wound and the packing was renewed. The patient grew rapidly weaker, the temperature rose to 105.4° F. and death occurred about nine hours after the operation. For this patient perhaps a better primary operation would have been a nephrectomy or a ureterostomy, the ureter being brought out through the loin. With uretero-vesical anastomosis in such a case there is a question if the dilated ureter would not serve as a pocket for residual urine and be a cause of later trouble.

CASE VI.—*Nephrolithiasis, ureterolithiasis, vesicolithiasis. Litholapaxy and secondary nephrolithotomy. Recovery.*

Mr. I. H., aged 30, tailor. Previous family history negative. Well nourished and developed. Enjoyed good health until three years ago when colicky pain developed in the right loin and was followed by the passage of a small amount of blood in the urine. The patient was free from pain for two years when there was a second attack of colic; since the second attack there have been repeated attacks involving the left loin but the right side is free from pain. Recently there has been a sudden cessation of the stream during urination followed by the passage of a few drops of blood stained urine. There is much irritability of the bladder with frequent urination. Skiagrams show a small shadow in the region of the pelvis of the left kidney, small shadows in the region of the lower end of the left ureter and also larger shadows in the area of the bladder. The patient was admitted to the Samaritan Hospital May 28, 1907, and two days later the vesical calculi were crushed and evacuated under spinal anesthesia. The operation demonstrated the importance of cystoscopy after litholapaxy to prove that all fragments have been removed. A few days after this a small stone was removed from the left renal pelvis.

As the stones in the lower end of the right ureter were producing no symptoms, and as they were so small that there was a possibility of their passing into the bladder, no attempt was made at their removal. The patient made an uninterrupted recovery and was discharged from the hospital seventeen days after the nephrolithotomy. Six months later the patient continued free from colic.

CASE VII.—Left ureteral colic due to right nephrolithiasis. Operation, exploration of both kidneys; left nephrolithotomy. Return of colic; passage of large calculi; final recovery.

Mrs. J. C., aged 38. Had suffered from recurrent attacks of numbness and colicky pain in the left loin for seven years. For the past two years the paroxysms have been much more severe. About January, 1906, the patient, after an attack of colic, passed a number of fair sized phosphatic stones. The X-ray showed about five calculi in the region of the right kidney but none in the region of the left. The patient has never had pain upon the right side. The urine was alkaline, had a specific gravity of 1.018; contained a trace of albumin; no sugar; and the microscope showed a moderate number of leucocytes, phosphatic crystals and some mucus. The patient was admitted to the Samaritan

Hospital March 14, 1906, and the same day both kidneys were explored under scopolamin-morphin narcosis. The left kidney was negative, and the kidney was at once replaced and the wound closed. The right kidney was incised and a number of calculi removed from the dilated pelvis. The right side was drained and the sinus remained open, with intermissions, until the following fall. During the summer the attacks of renal colic returned and in November, 1906, the patient again passed a number of phosphatic calculi after a severe paroxysm of ureteral colic. Since this time there has been no definite attack of colic and although the urine still contains mucus, a small quantity of albumin, and a moderate number of pus cells there is no symptomatic evidence of the return of the calculi.

CONCLUSIONS.

- (1) In the absence of infection bilateral or consecutive operations upon the kidneys are well borne.
- (2) Nephrolithotomy is frequently followed by the reformation of stone in the kidney.
- (3) Nephrostomy may not only fail to cure, arrest or prevent pyelonephrosis or relapsing nephrolithiasis but may even favor these conditions.
- (4) In operating for simple calculous disease of the kidneys spinal anesthesia by tropa-cocaine or stovaine is to be temporarily and with the most rigid aseptic precautions.
- (5) In bilateral and consecutive operations upon the kidneys spinal anæsthesia by tropa-cocaine or stovaine is to be preferred.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY.

Stated Meeting, January 8, 1908.

The President, DR. JOSEPH A. BLAKE, in the Chair.

TECHNIQUE OF NEPHRECTOMY.

DR. SAMUEL ALEXANDER presented four patients who had been subjected to nephrectomy by him, for the purpose of illustrating a method of surgical approach to the kidney which he had practised in most of his cases requiring nephrectomy during the past two years.

The incision was crescentic in shape, with the convexity of the crescent directed backward. The incision began at the lower border of the 12th rib at a point about two inches from the angle made by this rib with the erector spinae muscles. The greatest convexity of the incision corresponded with the outer border of this muscle, and the lower arm of the crescent was carried downward and forward, and ended at a point about two inches below the crest of the ilium. In its deepest points the incision followed the outer border of the quadratus lumborum muscle and the outer border of the latissimus dorsi muscle. In subjects of unusual muscular development, the muscle fibres of the outer border of the latter muscle had to be divided. The skin and subcutaneous fat inclosed in this incision formed a flap which could be drawn outward, thus affording the maximum amount of space. The lumbar fascia was then divided, and the peri-renal fatty capsule exposed.

The advantages claimed for this incision were: 1. That it gave ample room for the exploration of the kidney and for its delivery upon the loin. 2. There was a minimum division of muscle structure, and therefore the occurrence of ventral hernia was prevented.

In one case, the first in which this incision was used, the

crescentic incision was converted into the form of the Greek letter epsilon in order to secure more space than the first incision afforded. The crescentic incision had been used by Dr. Alexander in cases of rupture of the kidney, renal calculus, pyelonephrosis, tuberculosis, etc., with satisfaction and it could be recommended as doing away in most cases with the very extensive incisions which had come into fashion in recent years.

CASE I.—Male, 38 years old, a salesman, was admitted to Bellevue Hospital on May 25, 1906, and was operated on for prostatic abscess and stricture, a perineal prostatectomy being done. He was discharged on July 11, 1906, and remained well for about ten weeks. He then began to drink heavily and complained of some pain in the loin, which gradually disappeared. In May, 1907, he had fever and developed a pain in the right side. He went to the Post-Graduate Hospital, where he was operated on for gall-stones, and the gall-bladder was removed. He did not know if gall-stones were found. He remained in the hospital about a month, and left improved, but still complaining of pain in the right side.

When the patient was re-admitted to Bellevue Hospital, on October 1, 1907, he made the statement that his urine had always been "dirty," and a week before admission he began to have difficulty in urination. He had pain in the region of the right kidney which radiated down the loin into the genitals. On Sept. 21 he stated that he had passed a small putty-like mass, which on drying became hard, like lime.

Examination of the abdomen revealed tenderness on pressure in the right hypochondrium, with rigidity of the right rectus, possibly due to adhesions about the old scar along the costal margin anteriorly. A catheter was introduced and met with resistance in the prostatic urethra. This was dilated to 25 F. A cystoscopic examination showed marked redness and congestion about the right ureter, which was greatly dilated and from which pus was flowing. Upon massaging the right kidney, thick pus could be seen coming from its ureter. The left ureter was normal. The urine was light yellow; acid, with a specific gravity of 1.012, and contained a heavy sediment. The microscope showed many pus cells.

Operation: The kidney was very adherent, on account of the former gall-bladder operation. It was delivered with diffi-

culty, and the pedicle ligated *en masse*. The wound was drained and partly closed. The kidney was twice its normal size and contained four large abscess cavities, which drained into the pelvis, and many small abscesses.

The patient was discharged on December 5, 1907, in good general condition, with a small sinus posteriorly about 4 inches deep.

CASE II.—This patient was a Greek cigar-maker who was admitted to Bellevue Hospital on November 6, 1906. He denied all venereal history and stated that he had always been well, with the exception of the fact that about twelve years ago he had passed a stone about the size of a coffee bean.

Twelve days prior to admission he had severe pain in the right side of the abdomen and in the lumbar region, with frequency of urination. The pain did not radiate down into the testis, and gradually subsided. Four days after this attack the patient noticed that his urine was red; this continued for two days.

At the time of his admission he had neither pain nor hemorrhage, but attempts to urinate sometimes caused pain in the region of the right kidney. The right kidney was movable and easily palpated. The left kidney was also movable and palpable; not tender.

Operation, Nov. 17, 1906: The kidney was found to be greatly enlarged, and a small calculus was felt in the upper part of the ureter. While the renal artery was compressed, a blunt-pointed bistoury was thrust into the posterior surface of the kidney. When this was removed, a large amount of cheesy material was squeezed out. The kidney was then split longitudinally, and many miliary abscesses were found in its substance. After the kidney was delivered the ureter was examined by a probe, and a small calculus pushed into the bladder. The patient made a rapid recovery and left the hospital on November 28, 1906, with the wound nearly healed. The wound closed completely two weeks later.

CASE III.—The patient was a man, a patient of Dr. Alexander Lambert, who entered the hospital on March 7, 1906, complaining of hematuria which had been constant for two weeks. He had no frequency of urination, and no pain associated with the act. He complained of a dull, heavy sensation in the right loin, and while he gave no history of renal calculus he stated that

about twenty years ago he had passed on several occasions a large quantity of sand. This, however, was not accompanied by the passage of blood. He had gonorrhœa sixteen years ago, and again twelve years ago. During the last attack he had intense pain in the right side of the back extending down the right thigh and into the testicle. He had at that time frequent urination and a right-sided epididymitis, and stated that his gonorrhœa was followed by a stricture, which was cut internally. He had no history of cancer or tubercle.

An examination of the patient's urine showed that it was uniformly bloody. There was no residual urine. The urethra easily admitted a 26 F. blunt sound, and the capacity of the bladder was nine ounces. After the bladder was washed clean, clear fluid injected into it became bloody within half a minute, showing bleeding from the kidney. The sensitiveness of the bladder was not increased; no calculus was present. The right kidney was increased in size and palpable, and there was rigidity of the right abdominal wall. Pressure over the pelvis of the kidney caused pain to radiate along the course of the ureter to the end of the penis.

A cystoscopic examination showed a slightly inflamed bladder, congested in spots, but free from ulceration. The left ureter was normal in appearance, and discharging clear urine. The right ureter was situated in a depression, surrounded by a red and ulcerated area, and discharging blood and blood clots. The absence of tubercles in the urine and the presence of a large number of triple phosphate crystals made a diagnosis of renal calculus most probable, with retention of urine in the kidney, causing secondary phosphatic deposit.

Operation, March 20, 1906: The kidney was exposed by the usual crescentic incision, and a transverse incision was made through the skin and inner border of the quadratus lumborum muscle; this was two inches in length, beginning at the point of the greatest convexity of the first incision. The amount of perirenal fat was excessive. This was grasped firmly with strong pedicle forceps and divided between them, constant traction being made upon the forceps to draw the fatty capsule outside of the wound. The capsule of the kidney was adherent by numerous rather strong bands to the fatty capsule; the latter was cut away as the kidney was freed by the finger. The kidney was then

delivered upon the loin. It was of a mottled bluish-white color, and was much increased in size. In the upper pole, near the pelvis, a hard nodule could be felt. No stone was detected by palpation. On drawing the kidney forward, the pelvis was seen to be very much dilated. An incision sufficiently large to admit the index finger was made with a blunt bistoury through the kidney and into the pelvis, and the pelvis and calyces were explored by the finger. The hemorrhage was completely controlled by the finger in the wound. On the margin of this incision into the kidney there was a yellowish area which was in marked contrast to the purple congested surface of the cortex; a portion of this was cut out and on close inspection showed a number of small miliary spots which were regarded as tuberculous. The kidney was then removed, after tying off the pedicle with No. 2 chromicized catgut. The pelvis of the kidney was opened, and a bougie-a-boule passed into the bladder, which showed that the ureter was patent throughout its course. It was ligated with No. 2 chromicized catgut. The renal vessels were then grasped with a pedicle clamp on the distal side of the ligature, and divided with scissors; the ureter was then divided; a second ligature was then placed around the renal vessels and the clamp removed.

The kidney pelvis was found to be the seat of numerous ulcerations, surrounded by a zone of ecchymosis. Miliary tubercles were found in the pyramids, and the hard nodule near the upper pole proved to consist of a collection of small nodules, many of which were undergoing cheesy degeneration.

CASE IV.—Multiple miliary abscesses of the kidney secondary to multiple prostatic abscesses. Perineal prostatectomy followed by nephrectomy. Recovery. The patient was a physician, 24 years old, who was operated on May 3, 1906, for gangrenous appendicitis. The following September he infected his hand while operating, and as a result of this suffered from general sepsis. A month later he had an attack of typhoid fever lasting six weeks. In January, 1907, he contracted a urethral discharge which at first seemed a trivial matter, but in the course of two weeks numerous foci of suppuration developed in his prostate, together with a profound sepsis. On February 8, 1907, perineal prostatectomy was done, both lateral lobes being removed. These were the seat of multiple abscesses, the largest containing about half an ounce of pus. On the following day the perineal drainage

tube was removed. On February 16 the left epididymis became inflamed. On the 17th the patient complained of severe pain in the region of the right kidney, but as his temperature was normal, the pain was attributed to the epididymitis. On the 18th the patient was sitting up in a chair with a normal temperature. On the 21st, two weeks after operation, nearly all of his urine was voided through the urethra. Two days later, about two o'clock in the morning, he was seized with acute general pain in the abdomen which gradually became circumscribed in the region of the right kidney. The patient was nauseated and expelled much gas. At 8.45 A.M. the same day he had a severe chill; pain in the region of the right kidney continued and the patient vomited clear fluid. At 2.45 P.M. he had another chill and vomited a dark green fluid. Examination of the abdomen showed rigidity on the right side. There was severe pain on pressure over the kidney and also in the lumbo-costal region. His temperature, however, did not go above 98 until the second day of the attack, when it reached 102. On February 25 he had another severe chill, and an operation on the kidney was determined. A nephrectomy was thereupon done, and the patient made a slow recovery.

The four patients when presented were in perfect health, and the scars resulting from the operations were firm, small, and there was no weakening of the abdominal wall.

TRAUMATIC EPILEPSY.

DR. GEORGE E. BREWER presented a man of 30. Thirteen years ago he fell and sustained an injury to the right side of his head. Some five years after this injury he began to have epileptiform attacks. These at first occurred every five or six months, but later became more frequent, and during the past three months they had been repeated several times a day, unless controlled by bromides.

The patient was admitted to the Roosevelt Hospital for observation, and it was found that the attacks began by convulsive movements on the left side of the face and arm, afterwards extending to the left leg and finally becoming general. On the advice of Dr. L. Pierce Clark an osteoplastic resection was made over the right motor area. On removing the dura, a thickened mass was found, posterior to the Rolandic fissure, which on further examination was found to contain a small fragment of bone, which had evidently been driven through the dura and

into the substance of one of the convolutions. This was removed, the dura united, and the bone flap replaced. The patient made an uninterrupted recovery, and while before the operation he had as many as six or eight convulsions a day, he had not experienced a single one since he left the operating table. Dr. Brewer said that he did not feel justified, however, in offering a favorable prognosis, as the epileptic habit had been established for such a long time. He presented the case merely as one in which a definite lesion had been found.

DR. GEORGE WOOLSEY said that these operations were frequently done without finding anything. He recalled one successful case, which was already on record, where he found a spicula of bone projecting through the dura and surrounded by a cyst. According to the location of the lesion described by Dr. Brewer, it must have been behind the motor area in the sensory area, and was in corroboration of the view that a lesion of the sensory area might give rise, in a reflex manner, to epileptic disturbances. The speaker said that a case of idiopathic epilepsy of the Jacksonian type, of many years' duration, without any history of trauma, recently came under his observation, in which the attacks began by convulsive movements of the left hand. He exposed the motor area and with a single wire electrode was able to locate the hand centre in the precentral convolution, but there was nothing found here to account for the epilepsy. The question arises whether the cause of the irritation in this case also may have been in the sensory area, but as this is extensive and regional localization in it is not so accurately known, operation could not be so intelligently undertaken as in the motor area.

DR. BREWER, in reply to a question, said that electrical stimulation of the exposed brain area was not resorted to in his case. He had asked Dr. Clark what had led him to predict the presence of a lesion posterior to the motor area, and he said that he had based his opinion upon the following reasons: 1. That after thirteen years' existence, a motor lesion of sufficient size to produce such violent disturbance would probably have resulted in some paresis by this time. 2. That the epilepsy still retained its focal type. This fact had often been observed in cases where the lesion was a little remote from the motor area. 3. That not infrequently the lesion in these cases was in the sensory area, the motor explosion being simply a secondary affair.

TRAUMATIC RUPTURE OF THE PANCREAS.

DR. GEORGE E. BREWER presented a girl, eight years old, who had sustained a severe contusion of the epigastric region from a fall. The injury was followed by symptoms of profound shock, and when she was brought to the Roosevelt Hospital she seemed almost in a state of collapse, with feeble, shallow respirations, great pallor, cold perspiration and an almost imperceptible pulse. The condition was such as to preclude the thought of operation for the time being. She was placed in bed, surrounded by hot water bottles, and stimulating measures were applied. She rallied slowly and on the following day presented the following condition: Mind clear; pulse, 130; temperature, 99.5; abdomen distended, rigid and tender to palpation in the epigastric and left hypochondriac regions. There was evidence of free fluid in the peritoneal cavity, but no gas. The urine showed two and a half per cent. of sugar. The case was regarded as one of a visceral lesion and under ether anesthesia an incision was made through the left rectus muscle. The spleen was found slightly fissured along its anterior border, but the chief source of hemorrhage seemed to be in the region of the tail of the pancreas. This for an area about the size of a silver half dollar was crushed, and as soon as the blood clots were removed it bled freely. There was considerable ecchymosis of the surrounding tissues, particularly in the colon and the transverse mesocolon, in which there was a ragged tear. A mass of handkerchief gauze was packed over the bruised area, the distal end of which was allowed to protrude through a counter-opening near the anterior extremity of the 12th rib. All fluid and clotted blood was removed by flushing the abdominal cavity with normal salt solution. The original wound was closed tightly. The patient made an uninterrupted recovery.

In reply to a question, Dr. Brewer said that sugar was only present in the urine for one day. There was no necrosis of the wound, but the wound where the gauze was inserted healed very slowly.

HYDATID CYST OF THE LIVER WITH LIGATION OF THE PORTAL VEIN.

DR. GEORGE E. BREWER presented a woman, 38 years old, who was admitted to the Roosevelt Hospital suffering from an

epigastric tumor with periodic attacks of pain in the right hypochondriac region. Previous history negative. Three months before admission, the patient had suffered from an acute attack of pain in the region of the gall-bladder, associated with nausea and vomiting. Following this attack there had been a slight jaundice, which soon disappeared. Since that time the patient has suffered from similar attacks on a number of occasions, the pain, however, being more centrally located, and the point of greatest tenderness being just beneath and to the right of the ensiform.

On examination, an oval, elastic tumor was easily palpated in the mid-line, midway between the ensiform and the umbilicus. The tumor was deeply seated, apparently fixed to the deeper structures, and was moderately tender to pressure. The diagnosis rested between an echinococcus cyst of the left lobe of the liver and an abnormally located gall-bladder. An incision was made under general anesthesia extending from the ensiform to a point one inch below the umbilicus. When the peritoneal cavity was opened, a large oval mass was seen presenting in the mid-line and pressing upward the gastro-hepatic omentum and stomach. The gastro-hepatic omentum seemed thickened and highly vascular. A distinct sense of fluctuation could be felt within the tumor, which was apparently fixed to the inferior surface and posterior border of the liver. The right free border of the lesser omentum was felt, and the duct and hepatic vessels palpated. To avoid these structures, an incision was made through the gastro-hepatic omentum, exactly in the mid-line of the body, over the centre of the tumor, which exposed a smooth gray structure, which was supposed to be the fibrous envelope of the tumor. A large exploring needle was introduced through this fibrous structure, and clear fluid withdrawn. On withdrawing the needle, an active hemorrhage took place from the small opening. On attempting to control this by hemostatic forceps a larger rent was made, which resulted in a very copious flow of dark colored blood. The hemorrhage was temporarily arrested by digital pressure, and, dissecting away the superficial tissues, it was found that the structure which was supposed to be the fibrous capsule of the tumor was in reality a large vein, nearly 1 cm. in diameter, passing upward from the region of the pancreas to the transverse fissure of the liver. The calibre of the vein had evidently been much encroached

upon by the growth of the tumor, over which it passed in a flattened and ribbon-like condition. The vein from the upward pressure of the tumor was under a good deal of tension, and its walls were exceedingly friable. Two careful attempts to suture the wound were made with fine silk and a minute round needle. As soon as the pressure was removed, and blood coursed through the vessel, the stitches were torn out and the hemorrhage recurred. The vessel was finally doubly ligated, above and below the seat of injury.

As it was impossible to remove the tumor, and as it was impossible to bring it to the surface of the wound in such a manner as to unite its fibrous capsule with the abdominal wall, after packing off the intestines and all of the surrounding peritoneal space with a large mass of handerchief gauze, the cyst was freely opened and its fluid contents syphoned off. After this the gauze was removed and a large rubber drainage tube was securely sewed into the cyst opening. This was surrounded by a small mass of gauze packing, which extended from the surface of the tumor to the abdominal wall. The wound was closed, with the exception of that point through which the tube and packing emerged. The operation was a long one, and was followed by a considerable reaction. The temperature rose on the following day to 103° and later to 104°. The pulse was very rapid, but of good quality. The patient suffered only slight pain, and was soon able to take food in abundance.

The first dressing occurred on the third day, when the cyst was irrigated with normal salt solution, and a large amount of cloudy fluid and daughter cysts removed. At the second dressing, two days later, the cyst was washed out with a solution of nitrate of silver 1-8000. This was repeated every day, the strength of the solution being gradually increased until 1-2000 was employed. The result of this was to cause a marked shrinkage and opacity of the daughter cysts, which were washed away and continued to appear in the washings for some three weeks. The packing surrounding the tube was removed during one of the early dressings, but the tube was retained for five or six weeks, until the amount of secretion from the cyst cavity had been reduced to a very small amount. The wound was then allowed to heal by granulation. The temperature remained between 101° and 104° for three weeks, and then gradually came

down to normal. With this exception the patient presented absolutely no signs of illness or interference with normal nutrition. In fact, she had gained steadily in weight and color, and from being an anæmic and emaciated invalid had grown into a robust and healthy woman. The urine and other excreta have been carefully examined from time to time by Dr. W. J. Gies, Director of the Department of Biology of the College of Physicians and Surgeons, who reports no departure whatever from the normal.

The only explanation of this failure to observe marked changes in the nutrition of the patient seems to the writer to be that in the gradual growth of the tumor from below upward, the portal vein was carried away from its normal position toward the mid-line, and as a result of increasing pressure and the associated stretching of the vein, its calibre became gradually reduced and the collateral circulation was thereby established, which at the time of operation was so near complete that the diversion of the small amount of blood which was then passing through the obstructed vessel caused no perceptible increase in symptoms. This theory was strengthened by the fact that in the first incision one or more very large subcutaneous veins were encountered in the region of the umbilicus, such as were often found in advanced cirrhosis of the liver, or after Narath's operation.

SEPARATION OF UPPER EPIPHYSIS OF HUMERUS WITH DISLOCATION.

DR. ELLSWORTH ELIOT, JR., presented a boy, 14 years old, who was admitted to the Presbyterian Hospital on October 27, 1907, with the history that sixteen days before he had been knocked down by an automobile. He was unconscious for a time. Shortly after the accident, upon regaining consciousness, he complained of pain and disability in the right shoulder. The case was regarded as one of dislocation, and prior to his admission to the hospital two unsuccessful attempts had been made by the family physician to effect reduction under anesthesia. An examination revealed the fact that there had evidently been a separation of the upper epiphysis of the humerus, with displacement downward. An X-ray was taken, which showed the position of the head of the bone and the fact that the line of fracture corresponded very closely to the epiphyseal line.

The joint was exposed through a Y-shaped incision, one arm

of which passed through the deltoid, just below the acromion process, the other through the clavicular portion of the pectoralis major. Dr. Eliot said he had used this in a number of cases. It did not interfere with the nerve supply of either muscle, and gave an admirable exposure. When the parts were retracted it was found that the capsule of the joint was intact; the upper fragment could be distinctly felt within the capsule, and a few fibres of the latissimus dorsi were still attached; this, together with gravity, had displaced the head of the bone downward below the inferior lip of the glenoid cavity.

The upper end of the fragment was then exposed, and an attempt made to correct the deformity. With the arm abducted, this was quite possible, but when an attempt was made to extend the arm, the deformity recurred. The fragments remained in perfect apposition, however, with no tendency to displacement, when the arm was abducted to 45 degrees.

The wound was closed and the arm placed in a position of abduction of about 45 degrees, an extension apparatus of about five pounds was applied and kept in place three weeks. At the end of that time union was sufficiently advanced to prevent a recurrence of the deformity, and the arm could be placed in the ordinary position by the side of the bed. About this time the patient developed an attack of catarrhal appendicitis, of which he had had several previous attacks, and the appendix was removed. He was discharged, cured, on December 13, 1907. The operation on the shoulder joint was done on Nov. 1, and the functional result at the present time is practically perfect.

In connection with this case, Dr. Eliot exhibited an X-ray picture which still showed a slight amount of displacement, with the head of the bone in the glenoid cavity.

DR. ROYAL WHITMAN said that he had hoped to present a patient illustrating a perfect functional result after separation of the upper epiphysis of the humerus whom he had treated by a method which he thought should be more effective than that usually employed. The fragments having been separated by manipulation, the diaphysis was apposed to the epiphysis by traction and abduction, using the acromion, if need be, as a fulcrum. The arm in extension and full abduction was then raised to a position nearly parallel to the body line, and fixed by means of a plaster bandage until consolidation was assured. In Dr. Eliot's

case, although perfect adjustment of the fragments had been attained by the open operation, yet partial displacement had recurred afterwards. This was illustrated by the X-ray picture and demonstrated by the marked limitation of the range of abduction.

In reply to a question by Dr. Eliot, whether the method he had described could be successfully applied two weeks after the injury, Dr. Whitman said it should at least be tried, then it might be supplemented by the open operation if the fragments could not be disengaged.

Dr. Whitman said the aim of abduction was to approximate the upper fragment to the lower, the arm was raised above the head because it might be more conveniently fixed in this attitude. In the case presented, function should be improved as the irregularities at the site of the injury were lessened by the developmental changes. It would be, however, of advantage if primary and more accurate adjustment were possible because in some instances even comparatively slight displacement of the epiphysis had resulted in loss of growth.

DR. F. KAMMERER said he recently saw a woman, about 40 years old, who on December 24, 1907, sustained a sub-coracoid dislocation and a fracture of the surgical neck of the humerus on the same side. Six days after the injury, under anesthesia, the speaker said he was able to reduce the dislocation without operation. After several unsuccessful attempts to effect reduction by moderate traction on the lower part of the humerus and direct pressure on the head toward the cavity, and when he had practically made up his mind that an open operation would be necessary, he finally succeeded by manipulations. The four fingers of the right hand, excluding the thumb, could be passed around the head of the humerus with great ease, when muscular relaxation was perfect, and thus firm traction could be exerted.

DR. BREWER said that about a year ago he saw a case of this kind ten weeks after the injury in which the X-ray showed practically the same state of affairs as those described by Dr. Eliot; namely, deformity, epiphyseal separation and downward displacement. He did an open operation, and found, as Dr. Whitman had said, that by raising the arm the deformity was reduced, while bringing it down tended to cause separation of the frag-

ments. The speaker said that in his case a second operation became necessary, and at that time the arm was kept in the upright position for six weeks and a perfect functional result obtained.

DR. ELIOT, in closing, said that in his case, abduction was still improving, and he thought there was a fair probability of its complete restoration. The patient was now able to abduct the arm to about 60 degrees. At the time of operating, the reduction of the deformity required considerable traction because of the displacement of the head of the humerus downward.

OPERATION FOR UMBILICAL HERNIA.

DR. CHARLES N. Dowd presented a woman, 45 years old, who was admitted to the General Memorial Hospital in November, 1906. She had been suffering from a large umbilical hernia for fifteen years. The hernial mass was about 8 inches in diameter, and could not be reduced. There were various apertures in the fibrous portion of its wall. A gurgle could be distinctly heard on effort at reduction.

She was put on a restricted diet in the hospital, given saline cathartics and instructed to walk about the hospital corridors for a considerable period each day, and in this way her weight was reduced five pounds by December 5, but no success was met with in reducing it beyond that point.

Dr. Dowd operated on December 12, 1906, dissecting back the skin and subcutaneous tissue, and laying bare the fascia about three inches from the umbilical ring. On cutting through the hernial sac, to which he left a transverse ellipse of skin attached, he found that the contents of the sac were almost entirely intestine with a thickened mesentery, which contained a large amount of fat. There was hardly any omentum present, and what there was was adherent both to the sac and to the intestine in such a way as to make it impossible to dissect any large portion of it away. The adhesions between the intestine and the wall of the hernia were dissected away. It was impossible to avoid injuring the intestinal wall somewhat in this procedure, and two or three catgut purse-string sutures had to be taken. The amount of intestine which protruded through the ring would just about have filled a derby hat, and it was with the utmost difficulty and no small amount of force that they were returned into the abdomen. The transverse colon was the portion of intestine most involved.

The gap in the abdomen was closed by the Mayo overlapping method, with kangaroo tendon and chromic gut. There was some vomiting and prostration after the operation, but on December 15 gas and feces were passed. On that day her pulse was 80; temperature, 100. She still had a tendency to vomit, but looked well and made an uninterrupted recovery.

Dr. Dowd said there was no question about the value of the overlapping method of treating umbilical hernia—he had used it many times but this particular case furnished the most severe test of the method which he had seen.

NECK INCISIONS AND NERVE INJURIES.

DR. CHAS. N. DOWD presented three cases showing the effects of injury to the spinal accessory or lower filaments of the facial nerve, stating that these nerves had frequently been injured in neck operations with the feeling that the ill effects were usually temporary, and in any case were not very important. These cases had recently come to his notice and illustrated what might be expected from these injuries in certain instances.

He also showed three cases illustrating the difference in the results of longitudinal and transverse scars in the neck. Neck scars were so much dreaded that patients often postponed or avoided operations which were really needed, and although thoroughness of operation was the main desideratum, if that thoroughness could be accomplished through a transverse incision, the welfare of the patient was promoted since transverse incisions seldom stretch while longitudinal ones usually do.

CASE I was admitted to St. Mary's Hospital in March, 1898, about ten years ago. She was then five years old and had enlarged lymph nodes and numerous abscesses for three years. She also had a large mass of nodes and many cicatrices on the right side of the neck. An extensive dissection was done, and the sternomastoid muscle was cut above the entrance of the spinal accessory nerve, and the nerve was also divided. The portion of the nerve which supplied the sternomastoid muscle failed to unite, and there was an atrophy of that muscle. The trapezii, however, were normal, possibly because the nerves of the cervical plexus were sufficient to supply the muscle. She had very little shoulder droop and moved her head perfectly well. The change in the contour of her neck was the principal ill-effect which had followed the injury.

She was entirely free from recurrence, and had made an excellent recovery.

CASE II was admitted to St. Mary's Hospital on March 7, 1898, when he was eight years old. He had for two years suffered from tubercular cervical lymph nodes, with abscess formation. In the course of the dissection, which was very extensive, the posterior branch of the spinal accessory nerve, between the sternomastoid and the trapezius, was divided. Ten years after the operation he had a partial atrophy of the trapezius, which was about one-quarter the size of the other. The shoulder blade set higher than the other, and was rotated so that the lower angle projected backward, and the upper angle projected upward and forward at the trapezius border. The shoulder drooped and was also carried forward. This shoulder was not as strong as the other, but he was able to work as a brick-layer and said that he was not incapacitated for his work or for carrying weights. The right pectoralis was atrophied, and the motions of his chest were much less marked on the right than on the left side. He had no return of tuberculosis.

CASE III was first admitted to St. Mary's Hospital on December 26, 1896, with the history of having had repeated operations at various times for very extensive cervical tuberculosis. The glands at one time or another had filled in the tissues all the way from the parotids to the scapulæ, and in the process of the various dissections which were necessary, the collo-mandibular ramus of the facial nerve was cut, with resulting deformity of the mouth. This was due to paralysis of the depressor labii inferioris: there was a failure in the drawing down of part of the lower lip, which caused asymmetry in speaking, smiling, etc. The injury of this nerve was often said to be temporary, but it was sometimes permanent, as illustrated by this case.

CASE IV.—This boy, who was admitted to St. Mary's Hospital in 1905 at the age of three years, illustrated the effect of removal of the lymph nodes through a transverse incision. He had been suffering from enlargement of the lymph nodes for ten months, and the operation was an extensive one. The masses of nodes which were removed were as large as a small-sized bunch of grapes. He had remained free from recurrence up to the present time and the scar on the neck was scarcely perceptible.

CASE V, who was admitted to the General Memorial Hospital

on February 26, 1907, showed the result of a similar operation on a man who had enlarged lymph nodes for a year. The nodes were extensive, requiring a large incision. At the present time, eleven months after the operation, he was free from recurrence and the scar was hardly visible.

CASE VI illustrated the result of a longitudinal scar which was made fifteen months ago for the dissection of nodes which were particularly abundant in the posterior chain. Although the underlying fascia was united so as to raise the incision line in a ridge, there was still a stretching of $\frac{1}{2}$ to $\frac{3}{4}$ inch in the resulting scar. This incision was curved forward at its lower end and in this transverse part there was no stretching.

DR. CHARLES A. ELSBERG, in speaking of injury to the mandibular branch of the facial nerve, said the resulting paralysis from this accident was usually temporary. In two of his cases, both young women, in whom it occurred and remained for some time without signs of improvement, he resorted to the subcutaneous division of the corresponding branch on the opposite side. The loss of function from the injury was insignificant, and by dividing the opposite branch the slight deformity became symmetrical and less noticeable.

DR. ALFRED S. TAYLOR said that in one of the cases shown by Dr. Dowd, where the injury to the spinal accessory nerve had produced considerable deformity, it might be advisable to dissect out both ends of the divided nerve and suture them.

DR. DOWD said he had not seen some of these cases for several years after the original operation, and he doubted whether suture of the nerve would be serviceable after such a long period had elapsed.

DR. TAYLOR said that cases were on record in which suture of the nerve 29 years after the injury had been followed by nerve regeneration and return of muscular power.

SUBPHRENIC ABSCESSSES.

DR. ALEXANDER B. JOHNSON presented a woman, 27 years old, who was admitted to the hospital with the history of a typical attack of acute appendicitis which had lasted one week. The signs and symptoms of generalized peritoneal irritation and of sepsis were well marked. Upon operation, gangrenous appendicitis and gangrene of the right ovary with diffuse peritonitis

were found. On the fourth day, the patient had a severe chill and a rise of temperature to 105°. During the following 48 hours the physical signs and symptoms of right suphrenic abscess developed. The abscess was approached by resecting the ninth rib and suture of the parietal and costal layers of the pleura. A large amount of foul pus was evacuated from between the liver and the diaphragm. The patient made a slow but perfect recovery during the next three months. She left the hospital ten days ago. It was interesting to note that the left ovary also became gangrenous, and was discharged as a slough through the drainage opening which had been made in the vagina. The patient has not menstruated since.

DR. JOHNSON also presented a man, 30 years old, who was admitted to the hospital with the signs and symptoms of acute appendicitis 48 hours after the beginning of the attack. Operation showed a gangrenous appendix, with perforation and diffuse peritonitis. Ten days later an abscess situated in the left lower quadrant of the abdomen was incised, evacuating eight ounces of pus. Five weeks after the original operation, signs and symptoms of a right subphrenic abscess developed. The ninth rib was thereupon resected, and after suture of the costal and parietal pleuræ, one quart of pus was evacuated from between the liver and the diaphragm. The patient made a slow but complete recovery.

DR. JOHNSON, in reply to a question as to whether he made his incision through the diaphragm at once or subsequently, said that in one of the cases he had shown he had opened the diaphragm at once, and in the other he did not. In several instances were he had operated for abscess of the liver he had found that the two layers of the pleura showed no tendency to separate even though not adherent. In one of the cases of subphrenic abscess he had shown, the incision through the diaphragm was made at once, and there were no indications that air had entered the pleural cavity. In the other case he allowed an interval of 36 hours to elapse before incising the diaphragm. If the two layers of pleura were found infiltrated and adherent there could be no question about the propriety of immediate incision. If the diaphragm bulges up against the pleura, no air will enter upon incising the costal layer; if, on the other hand, the border of the lung can be seen moving freely up and down it will be safer to suture the

two layers and make the incision through the diaphragm after 24 or 36 hours.

DR. CHARLES H. PECK said that during the past summer he had operated on two cases of subphrenic abscess, one primary, the other following appendicitis, and in both he succeeded in getting good drainage by making an incision, resecting a portion of the costal cartilages in the mid-axillary line, and getting into the abscess below the pleural reflection without finding it necessary to go through the pleura. In a third case he did the same thing on the left side.

FRACTURE OF THE FEMUR OPENING INTO THE KNEE JOINT.

DR. ALEXANDER B. JOHNSON presented a man, 30 years old, who fell a distance of thirty feet with a ladder, striking upon his flexed knee. Upon admission to the hospital, examination showed the right knee flexed to an angle of 90 degrees. Active movement was impossible, and passive movement was very much restricted and painful. The knee was greatly swollen, and the condyles of the femur, together with the leg, were displaced backward. The sharp lower end of the upper fragment of the femur formed a marked projection upon the anterior aspect of the limb above the knee.

An immediate vertical incision near the middle of the anterior aspect of the thigh exposed the fractured femur opening into the knee joint. The lower extremity of the upper fragment of the femur ended in a sharp point beveled at the expense of the posterior surface. The condyles of the femur were separated by a line of fracture in the middle line, vertical in direction. A considerable fragment of the femur was found loose above the condyles and behind the lower end of the shaft, and was extracted. The lower end of the sharp fragment was sawn horizontally two inches from its lower extremity in order to furnish a flat surface for apposition with the condyles. The condyles were then drilled, and sutured together with chromic gut and the knee joint flushed with salt solution. The condyles were brought into apposition with the lower end of the upper fragment, and rubber tissue drainage extending to the point of the fracture was inserted. The entire limb, including the pelvis, was then covered with plaster-of-Paris dressing. Primary union resulted. The bones were

firmly united at the end of the tenth week, when the patient was allowed to walk in a light plaster dressing. At the present time, five months after the accident, the patient was able to use the limb without pain. Flexion is possible to more than 30 degrees. There is 1½ inches measured shortening. The amount of lateral mobility in the knee was slight. The amount of flexion was increasing.

DR. JOHNSON said the production of the fracture in this case was rather interesting. The man was quite certain that the injury was caused, not by the impact on the ground, but by a twist of the leg through the rungs of the ladder just as the latter reached the ground. Personally, the speaker said, he was inclined to believe that the injury was produced by the direct fall upon the lower end of the femur. There were no contusions on either side of the knee, such as one would expect from direct violence of any sort.

ON THE THYMUS GLAND TREATMENT OF CANCER.

DR. FREDERICK W. GwyER read a paper with the above title, for which see page 506.

DR. GwyER, in reply to a question as to why he had selected the thymus gland for this purpose, said that after experimenting with several of the glandular extracts, among them that of the pancreas, without any encouragement, it occurred to him that cancer of the thymus was almost unknown, that the disease was very rare in youth, when the thymus gland was prominent, and that it was such a common disease of old age, after the practical disappearance of the gland. He would prefer not going further into the details of his theories regarding cancer and its treatment at this time, but make it the subject of a future paper.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, January 6, 1908.

The President, JOHN B. ROBERTS, M.D., in the Chair.

GUNSHOT WOUND OF STOMACH, WITH POSTERIOR
DRAINAGE.

DR. EDWARD B. HODGE, JR., presented a man, aged 19 years, who was admitted to the Presbyterian Hospital on November 12, 1907, in the service of Dr. J. H. Jopson. Two hours before he had been accidentally shot with a BB bullet from an air rifle from a distance of 100 feet. The bullet penetrated a wire screen-door, shirt and undershirt, making a small wound 2 inches below the ensiform slightly to left of median line. Patient had taken no food for 5 or 6 hours, had not vomited and was in good condition. Temperature, 98.8°; pulse, 84; respiration, 26.

Immediate operation by Dr. Hodge. Incision through wound showed penetration through left rectus ranging toward left. A perforation in anterior wall of stomach near lesser curvature and nearer cardiac than pyloric end was closed with silk purse-string suture, reinforced by interrupted silk Lemberts. Little soiling of peritoneum. Air and blood were noticed behind gastro-colic omentum. This structure was torn through, and a perforation found on the posterior wall of the stomach toward the cardiac end. This was closed in a similar manner. No other injury could be found, but in view of the wound of the posterior stomach wall and a possible pancreatic lesion, posterior drainage was considered wise. Through a small incision in the left costal space a long forceps was pushed into the lesser peritoneal cavity and a medium-sized rubber tube withdrawn. The gastro-colic omentum was closed over this after dry sponging of the peritoneum. A small cigarette drain was inserted to the anterior stomach wound and both incisions closed with interrupted silk-worm gut.

For 24-36 hours the patient gave considerable anxiety on

account of marked restlessness, rapid pulse, 130-160, and respiration, 30-40, with some distension of the upper abdomen. After the second day convalescence was smooth. On day after operation there were 3 dark tarry stools, and for 10 days 1-3 of similar though lighter color. Tube was gradually shortened on account of moderate purulent discharge. Stitches removed on tenth day and patient discharged in 4 weeks.

DR. GEORGE G. ROSS said that, several years ago, at the Germantown Hospital he saw an Italian who had been shot. The ball went in the lower chest wall between the lower ribs, ranged downward and inward. The skiagraph showed the bullet resting against the vertebral column. The man was shot when his stomach was absolutely empty. There was reason to believe from his bowel movements that the bullet had gone through both walls of his stomach. He absolutely refused operation. He developed quite a cough and violent peritonitis, but finally got well without operation or drainage. Dr. Ross believes that there was a reasonable doubt as to perforation of the stomach, although it was thought there was from the clinical facts.

STAB WOUND OF THE DIAPHRAGM.

DR. FRANCIS T. STEWART reported the case of a man, aged 22 years, colored, who was admitted to the Pennsylvania Hospital December 14, 1907, in the service of Dr. Gibbon. The patient had been stabbed in the left mammillary line with a penknife, which entered the sixth interspace, cut through the seventh costal cartilage obliquely downward and outward and severed the muscles of the seventh interspace, the resulting wound being 3 inches in length. Through this wound protruded a portion of the stomach about the size of an orange. The pulse was 100, the temperature normal, and the respiration quiet. There was considerable pain in the region of the wound, rigidity of the left side of the abdomen, but no vomiting, displacement of the heart, or pneumothorax. Under ether anesthesia an incision was made through the left rectus abdominis. That portion of the stomach which protruded through the external wound was then pushed into the thorax, and the opening plugged with gauze in order to prevent the entrance of air. The stomach was then drawn upon from the abdominal cavity, but owing to the negative pressure in the thorax, reduction was found to be rather difficult until assisted by pressure from above through the thorax. The stomach was un-

injured and there were no other visceral lesions. The hole in the diaphragm was about $2\frac{1}{2}$ inches long and ran in the direction of the muscular fibers, from the pericardium downward and outward. After pushing the diaphragm upward with the hand in the abdomen the wound in the diaphragm, the edges of which were about $\frac{1}{4}$ of an inch in thickness, was sutured, through the seventh intercostal space, with catgut without resecting a rib. The severed costal cartilage and the intercostal muscles were sutured with catgut, the skin with silkworm gut, no drainage was employed, and the diaphragmatic region was immobilized with adhesive straps. During the operation some air entered the thorax, but later there was no displacement of the heart and only a slightly higher pitch in the percussion note over the thorax. The lung was neither seen nor felt during the operation. The following day there was some pain and slight dyspnoea, both of which subsided in the course of 48 hours. The wounds healed by primary intention, and the patient left the hospital on the sixteenth day.

DR. JOHN N. GIBBON recalled a case of his own at the Pennsylvania Hospital several years ago, that of an Italian who was stabbed in the back and when he was seen by Dr. Gibbon shortly after the injury there was protruding through a wound at the lower angle of the scapula quite a mass of omentum, as large as three or four fingers. In this case Dr. Gibbon resected a rib, ligated and removed a portion of the omentum, returned the stomach to the abdominal cavity and closed the diaphragmatic opening. The knife the patient was stabbed with was a small one which passed between the ribs, and one rib acting as a fulcrum the knife cut a $2\frac{1}{2}$ inch opening in the diaphragm. Dr. Gibbon opened the abdomen because he was afraid there might be an injury of the stomach but nothing was found and the abdominal wound was therefore closed. The patient did well for 24 hours but then developed a double pneumonia, and the man died 6 or 7 days after the receipt of his injury. An autopsy was performed and the pneumonia on the side where the patient had been injured was found to have practically subsided. His wound had completely healed and the active process was all on the opposite side.

DR. HARRY C. DEAVER said that in subdiaphragmatic abscesses complicating appendicitis he had resorted to drainage by resecting the tenth rib posteriorly and making the incision in

the diaphragm, stitching it to the muscles of the chest wall. He has found this very successful and also that it gives good drainage. Subdiaphragmatic abscesses are very hard to drain. In the last case upon which he operated, relieving the abscess in the way described, he depressed the liver and ran a large drainage tube between it and the diaphragm. This drained very nicely and there was no unpleasant results from stitching the diaphragm to the muscles of the chest wall.

DR. JOHN B. ROBERTS said that a good many years ago when he did his first nephrotomy he punctured the diaphragm by accident. He could hear the whistling of the air in the chest. The patient, however, recovered satisfactorily.

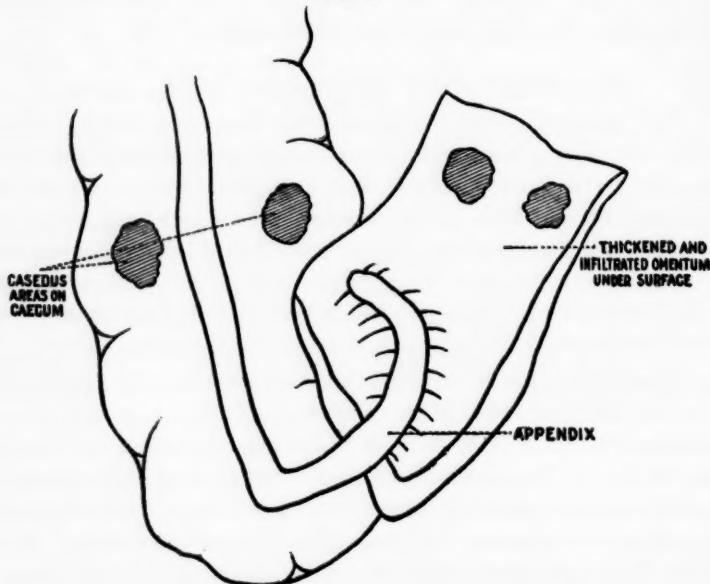
PRIMARY TUBERCULOSIS OF THE CÆCUM.

DR. JOHN H. JOPSON reported the case of a man, aged 26 years, who was admitted to the Presbyterian Hospital, October 14, 1907. His family history was negative. Six weeks before admission he had been knocked down by a horse, and a wagon ran over him, the wheel passing over the left thigh just below the hip, and across the right iliac fossa. He had considerable pain in the abdomen and in the left hip, which lasted about three days, when he returned to light work. Pain continued, but of mild degree, until a week later, when he attempted heavier work, and from that time he suffered more severely, until 2½ weeks before admission, when he had to quit his work. He then detected a mass in the abdomen, which he thinks has increased in size, and since then has become the seat of increasing pain. Three weeks before admission he says he passed blood by the bowel for three days. Since then there have been daily bowel movements, sometimes loose, sometimes constipated. He has only vomited once. His appetite has been poor, and his only nourishment of late has been milk. Previous to his injury he had been in good health.

On admission his temperature was 100°, pulse 120, respiration 28. He was in good condition, well nourished, although of rather spare physique; nothing of note in the chest. There was a mass in the right iliac region about the size of a small orange, moderately sensitive, and the seat of pain. Leucocyte count, 18,100. His temperature fell below normal the day after admission, and continued below normal, between 97° and 98°. The pain and tenderness lessened, and the mass decreased apparently in size. On the 21st, one week after admission, the leucocyte

count was 14,000, and three days later 9,700. Operation October 25, 1907. Incision over the tumor showed it to be intra-peritoneal. The mass was formed of a portion of the end of the large omentum, overlying and adherent to the anterior wall of the cæcum, and the entire mass was fastened to the peritoneum over the inner wall of the false pelvis. The cæcum and adherent omentum were peeled off, which disclosed a few caseous areas on the underlying peritoneum. The omentum was stripped from the cæcum to the anterior surface of which it was adherent. Examination

FIG. 1.



Primary tuberculosis of cæcum. In this sketch the diseased portion of omentum has been separated and turned over, showing the relationship of the appendix.

of the under section of the portion of omentum so liberated showed the appendix adherent to it, small, short, and stripped of its peritoneal coat. Two caseous areas, about $\frac{1}{3}$ inch in diameter, marked points on the cæcum adhesion (Fig. 1). The rest of the peritoneal coat of the cæcum was inflamed and thickened. There was no gross enlargement of the cæcum, however, and the neighboring intestines were normal in appearance. The adherent omentum was much thickened and altered in appearance, for a distance of $2\frac{1}{2}$ inches by $1\frac{1}{2}$ inches, and was $\frac{3}{4}$ of an inch in thickness. It was ligated from the rest of the omentum,

and removed with the appendix fastened to it after ligation of the base of the appendix. Iodoform gauze strips were packed over the raw surfaces, and the wound partially closed.

Convalescence was uninterrupted, and the wound was healed in about three weeks. The temperature remained normal, and no induration was present beneath the scar. Pain was entirely relieved. Careful physical examination before discharge was practically negative. There was a slightly duller note and some increase in tactile fremitus over the right apex, but no râles. He gained weight and strength, and was discharged in good condition.

Careful examination of the excised omentum showed on microscopic examination a caseating, tuberculous infiltration. This was confirmed by microscopic study. Serial sections of the appendix were made, which from its position in the mass was suspected to be the seat of the primary infection. These failed to show the presence of tuberculosis. The pathological diagnosis was, therefore, a primary tuberculosis of the cæcum, which would be included under the entero-peritoneal type of Hartmann and other writers, and secondary tuberculosis of the omentum. The omentum had well fulfilled its function of "abdominal policeman" in covering over the primary focus and assisting in the prevention of more extensive peritoneal infection.

Dr. JOPSON added that Henry Hartmann, in an address on the "Surgical Forms of Ileo-Cæcal Tuberculosis," before the Medical Society of London, December, 1906 (Brit. Med. Jour., 4-13-1907), gives a clear and concise review of the subject and an analysis of cases operated upon. Charles Greene Cumston has recently covered the subject very thoroughly in connection with a report of two cases (*ANNALS OF SURGERY*, Nov., 1907). Hartmann points out that the cæcum is the commonest seat of tuberculosis in the entire intestine, and that when the only portion of intestine involved it is usually a primary infection. Tuberculosis of the cæcum attacks by preference adults between 20 and 40 years of age. The cases admitting of surgical treatment are divided into the entero-peritoneal and hyperplastic types. In the first the cæcum, and with it frequently the ileum, is the seat of ulcers, and around it develop secondary peritoneal inflammation, adhesions, abscesses, and oftentimes fistulous tracts opening externally. The hyperplastic type, on the other hand, which is the most important surgically, is generally limited to the cæcum, beginning near the valve, and when it spreads, does so

toward the colon; it is marked by an increase in size of the cæcum with great thickening of its walls, and oftentimes the formation of a fibro-adipose enveloping mass. It is commonly non-adherent; its cavity is greatly decreased in size, frequently the site of stricture, and the mucous membrane is usually ulcerated. The appendix is often involved in the inflammatory exudate, but is usually patent. As Hartmann points out, the infection may simulate one of two commoner conditions; viz., appendicitis and malignant tumor. The first-mentioned is commoner as a symptom-complex in the enteroperitoneal form; the second in the hyperplastic variety. Appendicial symptoms are preceded in the enteroperitoneal form by symptoms of enteritis, diarrhœa, bloody stools, etc., and later the mass, with localizing symptoms of pain, tumor, etc., appears in the right iliac region. Abscesses and fistulae form, and pulmonary tuberculosis oftentimes develops later. It will be noted how closely the symptoms in the case here reported resemble those of the typical enteroperitoneal class. The diarrhœa, bloody stools, and later developing local symptoms were all present. The history of traumatism helped to mask their importance. How much the traumatism had to do with causation of the condition is a question.

Attacks resembling sub-acute appendicitis may develop in the course of hyperplastic cæcal tuberculosis; but the symptoms in general are those of slowly developing malignant tumors, with incomplete obstruction, alternating constipation and diarrhœa, colic and digestive disturbances. A tumor is usually present, and the course of the disease is toward a fatal issue in from $2\frac{1}{2}$ to 3 years.

Resection is the operation of choice in the hyperplastic form. In the enteroperitoneal form, where the peri-cæcal infiltration is such a prominent and early lesion, resection is generally inadvisable. Simple laparotomy has resulted in a cure when the peritoneal lesions were few in number and intestinal ulceration absent. In severe cases, or when adhesions are very extensive, the operation of intestinal exclusion, unilateral, or, in the case of fistula, bilateral, performed on the cæcum, is indicated for the enteroperitoneal type.

Hartmann analyzes 229 operations for cæcal tuberculosis, with a death list of 46. Since 1900 the mortality has been but 12 per cent.

DIAGNOSIS OF RENAL DISEASE AND SUFFICIENCY.

DR. B. A. THOMAS read a paper with the above title, for which see page 588.

DR. JOHN H. GIBBON asked if Dr. Thomas could tell how many cases there have been of infection of the primarily healthy kidney from ureteral catheterization. It was his opinion that there was a certain amount of danger. For instance in the case of a patient with a tuberculous kidney with secondary involvement of the bladder there would be a certain amount of danger in carrying the infection into the well ureter unless the greatest care was exercised in cleansing the bladder thoroughly and in manipulating the catheter. Dr. Gibbon believes that the indiscriminate and careless use of ureteral catheters may result in injury of a perfectly healthy ureter and its corresponding kidney. He considers this a method of diagnosis which is of undoubtedly value, but it is only one means, and he thinks that if a diagnosis can be arrived at by means of a cystoscopic examination of the ureteral openings, as was done in two of the reported cases, it is better, especially in the presence of a bladder infection.

Dr. Gibbon referred to a case of a physician who had blood and pus in his urine, frequent micturition; he had no abdominal symptoms, no tumor or tenderness over the kidney, but he gave a history of having what he thought was an attack of appendicitis, which passed off. This attracted Dr. Gibbon's attention to the right kidney; he used a cystoscope on his patient with very little satisfaction, which he thought was due to the presence of blood. He then did a suprapubic cystotomy and found a large ulcerated area involving the right ureteral opening. The other ureteral opening was apparently normal. The bladder wound was healed in less than two weeks, and Dr. Gibbon then exposed the left kidney in order to determine its condition, as has been recommended by Leonard Freeman. This required only about ten minutes, and demonstrated a perfectly normal kidney. The right kidney, which was the seat of an extensive tuberculosis, was then removed. Within 48 hours after the removal of the kidney the patient could hold his urine for quite a little time, much longer than before the operation. He made a prompt recovery and before he left the hospital had to empty his bladder only once at night. At the present time the bladder function is perfectly normal, and the patient has resumed active practice.

Dr. Gibbon also referred to ureteral catheterization in cases

of ureteral calculi. He recalled two instances where the ureters had been catheterized by experienced men, and in which no ureteral stone could be definitely located. In one of these cases Dr. Gibbon removed a stone 18 months after catheterization, and in the other 6 months after catheterization. He believes that in these cases the X-rays are of far more value than ureteral exploration. Probably in the hands of an experienced man the use of the wax-tipped catheter might be relied upon in such cases.

DR. B. A. THOMAS replied that personally he had never seen a case of infection that could be ascribed to catheterization of the ureters. A couple of years ago he had an opportunity to visit Zuckerkandl in Vienna, where a great deal of work is being done along this line, and he took the opportunity to ask him whether he had ever seen a case, and much to Dr. Thomas' surprise Zuckerkandl replied in the negative. Dr. Thomas had expected that occasionally some such condition might arise. He thinks the danger can be reduced to such a minimum by thorough irrigation of the bladder with a sterile solution and thorough asepsis in instrumentation, that it is hardly worthy of consideration.

With reference to ureteral calculus Dr. Thomas said he thought that the catheterization of the ureters is probably not of so much value in the determination of this condition as the employment of various so-called chromo-cystoscopies, or the employment of the X-ray.

NOTICE.—ENDO-ANEURISMORRHAPHY:

DR. MATAS, 2255 St. Charles Avenue, New Orleans, La., writes that he is compiling the statistics of operations for the radical cure of Aneurism by the method of intra-saccular suture (Endo-Aneurismorrhaphy) and will be obliged to all the surgeons who have had experience with this operation for brief reports of their cases.

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